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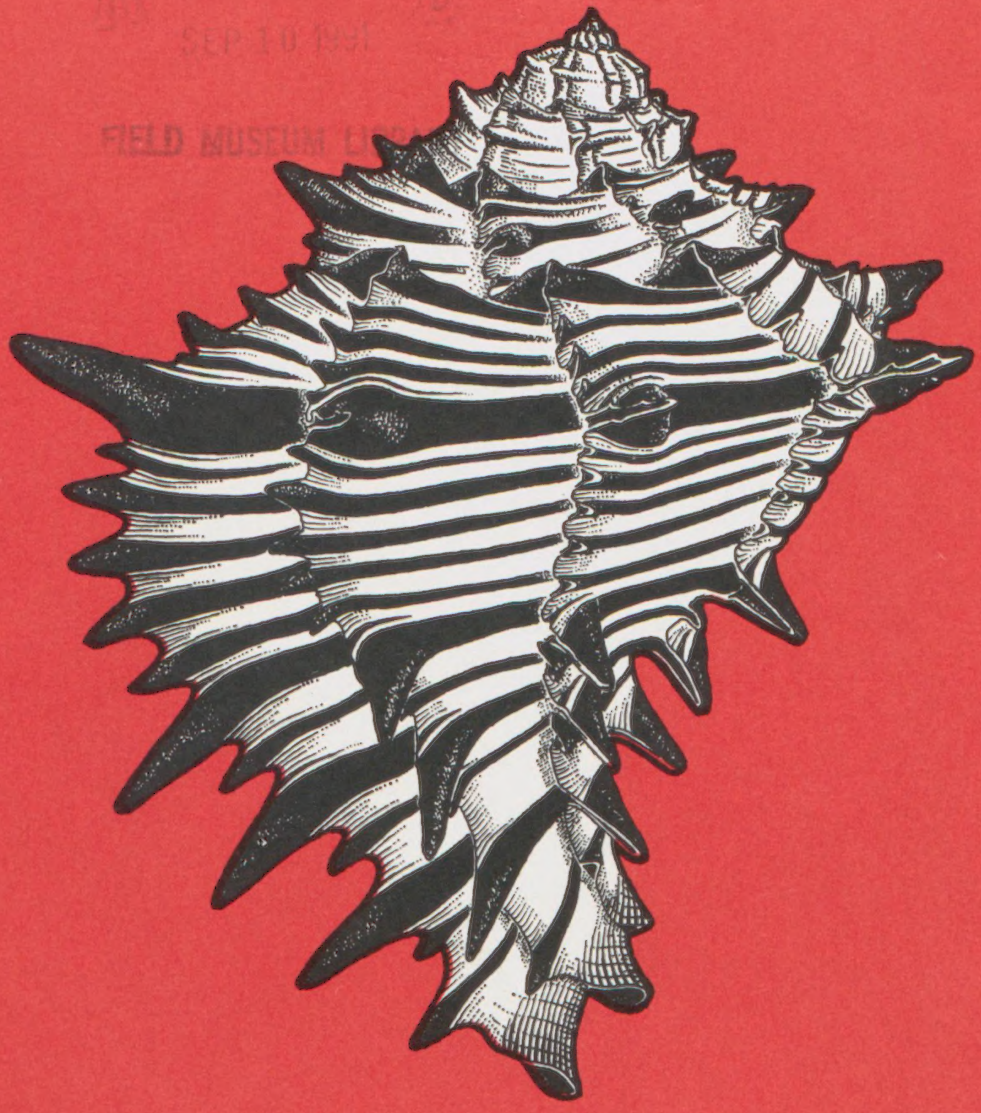

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MOLLUSCA IN FICTION

Marjorie Fogan[1]

PRESIDENTIAL ADDRESS

(Read before the Society, March 1990)

T. E. Crowley's Presidential Address of 1973 was entitled *Fictional Mollusca* and has inspired the compilation of further examples of the appearances of Mollusca in fiction. References will occasionally be made to Crowley's work but this is really not intended as in any way a recapitulation. As he justly observed the Mollusca are not a promising subject for a work of fiction, but nevertheless many authors have made use of them and it is perhaps of interest to consider some of the ways in which molluscs, dead or alive, appear although it has to be admitted that they have not inspired a great deal of deathless prose.

Twenty Thousand Leagues Under the Sea by Jules Verne, is discussed by Crowley, who observes that some of the descriptions appear to have been taken straight from a textbook. I would suggest they were taken from Landrin's *Les Monstres Marins* published two years earlier. All Landrin's most spectacular items seem to be included, but Captain Nemo's specimens are bigger and better.

Edible Mollusca appear frequently, but in a very passive role. The most famous in fiction must be the oysters which the Walrus and the Carpenter devoured in *Alice Through the Looking Glass*, closely followed by Sam Weller's observation that "poverty and oysters always seem to go together". *The Last Days of Pompeii* by E. Bulwer-Lytton has a group of Roman epicures discussing the oysters of different locations and deciding that there may after all be something to be said for the poor wretched Britons: "at least they have an oyster". *Silvershell, the Story of an Oyster* is presumably fiction, but I have not seen a copy.

Escargots are often eaten in expensive restaurants in stories of high life, but the eating of slugs and snails is integral to the two stories *Snaily House* by S. Baring-Gould, and *The Outlandish Ladies* by A. Quiller Couch, both mentioned by Crowley. These are both obviously based upon an account given by Jonathan Crouch in the *History of Polperro*. Two maiden ladies lived alone in a retired spot. Since they possessed no obvious means of support they were suspected of sheep-stealing when a local farmer lost one or two sheep. A warrant was obtained and their house was searched but nothing was found except a quantity of snails salted in pots for their food; they died soon after, unable to survive the suspicion of guilt.

Both authors embroidered the basic plot. Baring-Gould added a romantic interest by introducing young nieces, but Quiller-Couch wrote a much more tragic tale. Crowley had not seen *The Outlandish Ladies*; A. E. Boycott in 1933 investigated a house near the East Dart marked "Snaily House" on the map, and implied that *The Outlandish Ladies* is a similar story to *Snaily House*. Thanks to Mrs. S. M. Turk and Mrs. Sheila Stirling, I have been able to read *The Outlandish Ladies*, and Mollusca are barely mentioned in it. The two old sisters are foreigners and suspected of witchcraft. When sheep are missing the local farmer and his friends force their way into the lonely house despite the frenzied efforts of one of the sisters to prevent them. A few salted snails are found, but they discover the true reason for the sisters' reclusiveness; they burst in upon a dying leper, and flee in terror. Parson Morth, the sisters' only friend, berates the villagers and goes to visit the ladies. He finds one sister dead in the kitchen, her hands stained with earth, while behind the cottage is a freshly formed mound

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which is the grave of the leper. ("Snaily House" has disappeared from recent O.S. maps, although a map of 1942 shows it as "ruins".)

After mentioning oysters, perhaps something should be said about pearls. Accounts of pearl-diving are not uncommon, and ladies often appear in ropes of pearls which are not essential to the plot, but in *Mr. Know-All* by Somerset Maugham a pearl necklace is the centre of the action. The setting is a liner and "Mr. Know-All" is the nickname given to Mr. Kelada, the most unpopular passenger. He takes charge of all entertainments, brags incessantly of his achievements, and is regarded as an utter bounder. At dinner one evening he brags of his expert knowledge of pearls, and praises the beauty and value of a pearl necklace worn by a young lady passenger. She insists that it is only a cheap imitation and her husband, pleased to humiliate Mr. Know-All, bets him a hundred dollars that he is wrong. The lady is reluctant, but her husband hands over the necklace for examination. After using a magnifying glass Mr. Know-All has a triumphant expression, but as he is about to speak he observes that the lady is white and appears about to faint. He flushes and says "I was mistaken; it's a very good imitation and worth the eighteen dollars you paid for it," and pays the husband the amount of the bet. Mr. Know-All has been made to look a fool and his fellow-passengers are greatly amused. Next morning an envelope is delivered at his cabin and he takes out a hundred-dollar note. "Were the pearls real?" asks his cabin-mate. "If I had a pretty little wife I shouldn't let her spend a year in New York while I stayed at Kobe," he replies. And the cabin-mate decides he does not entirely dislike Mr. Kelada.

Pearl Maiden by H. Rider Haggard has no interest for conchologists. It is a story of Christian martyrs in Rome, and the heroine wears a pearl necklace.

The Mollusca may be seen in the light of collectable items, and exotic marine shells are usually those desired. *The Glory of the Sea* (Darley Dale), *The Gasteropod* (M. Ross) and *The Shell Hunters* (G. Stables) all deal with this aspect and have been discussed by Crowley. A complete contrast is *Grandad with Snails* by M. Baldwin. Here two small boys are infected by a collecting mania. They collect all kinds of snails by the bucketful and keep hundreds in tea chests. They play happily with them for weeks but are finally discovered and ordered to get rid of them. They are mainly distributed in the family cabbage-patch! *The Shell-Seekers* by R. Pilcher has despite its title nothing to do with shells or collectors. A picture of children on a beach is called "The Shell Seekers" and is the cause of family dissension.

From the Diary of a Snail by Günter Grass concerns the 1969 election campaign in West Germany, and the snail is purely symbolic. "What do you mean by the snail?" "The snail is progress." "What's progress?" 'Being a little quicker than the snail."

Snail, by Richard Miller, is described as a fantasy. It might also perhaps be called a farrago. A German field marshal receives an elixir from the Wandering Jew, becomes an immortal sixteen-year old boy and escapes (with an immortal nine-year old Hitler) from Hitler's bunker. He becomes a protegé of the goddess Athena, spends years meeting legendary and divine characters and is eventually turned into a snail. In this form he enjoys a peculiar erotic experience with Athena who is also for the time being transformed into a "warm-blooded snail". He subsequently returns to normal shape. I have no idea what this is intended to convey.

Generally speaking the cephalopods are unpopular with authors and are presented as objects of terror. The only exception appears to occur in *Realms of Gold* by M. Drabble, in which the heroine sees an octopus in a tank and meditates upon the maternal virtues of the female octopus; one feels that the author must have seen the Cousteau film on this subject.

Toilers of the Sea (V. Hugo) and *Twenty Thousand Leagues under the Sea* (J. Verne) both include a struggle with a giant octopus and were discussed by Crowley. The Disney film of *Twenty Thousand Leagues under the Sea* had an artificial octopus which was quite effective except for the beak, which was upside-down.

Octopussy by I. Fleming is in the same tradition. While employed in Austria in the

investigation of war crimes Major Smythe steals a hoard of Nazi gold and kills his Austrian guide by pushing him into a crevasse in a glacier. He goes to Jamaica and lives happily for years on the proceeds of his crime. He enjoys diving and recognises individual reef fish, including the octopus which he calls Octopussy and is attempting to tame. The glacier having finally given up the victim's body James Bond arrives to arrest the major. He goes for a final swim and is stung by a poisonous fish; he spears it and offers it to Octopussy as a parting gift. He is delighted when a tentacle takes him by the hand, thinking it a friendly gesture, but he is pulled down and drowned. Local fishermen catch and eat the octopus, and the death looks like a gentlemanly suicide, but the autopsy proves otherwise. (Fleming would not be regarded by many as a conchological writer, and *Octopussy* is the only one of his works in which a mollusc is important, but at least three of his books have a minor interest. In one, Bond has a girl-friend who collects professionally, in another a different girl-friend is employed in the Japanese cultured-pearl fisheries, and in another, Bond, in a nefarious fish and shell dealer's establishment, flings large conch shells at his adversaries.)

A. C. Clarke has a fairly sympathetic attitude towards the giant squid. *The Deep Range* is discussed by Crowley, and an earlier short story *Big Game Hunt* also features *Bathyteuthis* in a humorous anecdote. A scientist, Grinnel, is quietly working on a process to influence the movements of animals by means of small electrodes; he has been successful with many invertebrates, including snails and slugs. He is approached by a more colourful scientist who is regarded as a publicity-seeker who leads expeditions which are mainly concerned with producing best-selling books and films. He and Grinnel announce that they intend to go big-game hunting, ostensibly in Africa. They actually set out for the Atlantic and really big game – the giant squid. Grinnel succeeds in controlling the animal, while his colleague shoots off yards of film. To Grinnel it is just another mollusc, which he would soon allow to return to its normal depths. (The radio-operator is concerned and keeps in touch with a friend on land.) Unfortunately in the excitement Grinnel has forgotten to provide a spare fuse, and when it blows out – "you can't really blame *Bathyteuthis*, either. Wouldn't you have been a little annoyed to be pushed about like this? And when the orders ceased and you were your own master you'd take steps to see it remained that way. I sometimes wonder though, if Jackson stayed filming to the very end. . . ."

Slugs invariably appear as objects of horror. *Slugs* (S. Hutson) was the subject of a review by A. Norris in the *Conchologists' Newsletter*, in which he pointed out that the man-killing slugs depicted were an impossibility. The sequel, *Breeding Ground* is even more horrendous and totally impossible. Slugs infest London sewers. They are extremely large, move swiftly in large swarms and can swim; they stab their human victims with a "large central tooth" and devour them in minutes. Worse is to come. Contact with their slime causes their victims to develop lumps and become raving mad and to murder anyone available. A pathologist discovers "flukes" in the blood which encyst in the brain (causing madness) and subsequently "metamorphose into slugs." He suggests that "slugs have interbred with some other carnivorous species, perhaps even with another gastropod like a leech". All biologists will be fascinated! After many revolting deaths and the declaration of a state of emergency the slugs are finally electrocuted in the sewers, but a small boy fleeing London is developing suspicious blisters, so presumably a further sequel may be expected.

Two good horror stories about snails, *Blank Claveringi* and *The Snail-Watcher* by P. Highsmith were discussed by Crowley. *The Sign*, by Lord Dunsany, appeared in a collection of "horror stories" but must be considered a very mild, indeed whimsical, example of the genre. Horcher, a believer in transmigration, is vain enough to anticipate his reincarnation in some very superior station – possibly as a king. He tells a younger friend that he has trained himself to remember in any circumstances a sign, the Greek letter *Phi*, and that he will be able to prove the truth of transmigration by making the sign. As they talk they are strolling in a garden. Horcher treads carelessly on snails on the path; it cannot matter to

such low forms of life. After Horcher's death his friend expects that one day some exalted person will make the sign, but walking again in the garden he notices a snail upon the wall. Slowly it traces with its slime a perfect circle, then a vertical line intersecting it and forming the letter *Phi*.

It is perhaps in the realm of crime fiction that Mollusca most often appear. Sometimes they provide clues. In two of Austin Freeman's Dr. Thorndyke stories (discussed fully by Fogan 1980) the murders are solved because in one case Dr. Thorndyke knows that the distribution of some species of snails is extremely local, and in the other he realises that different fresh-water habitats may contain different species. Curiously enough a recent newspaper story indicated that a fresh-water snail found in a shoe was a clue to a crime.

The Left-Handed Shell by James Grant is a spoof detective story. Two schoolgirls are kidnapped for ransom and allowed to telephone to confirm that they are alive. The brighter of the two says "I hope to have a sinistral dog-whelk for my collection," and the detective decides this must be a subtle clue. In her bedroom at the school he finds a picture of a left-handed dog-whelk and a copy of S. P. Dance's *Shells and Shell Collecting*; from this he learns the story of the finding of a sinistral dog-whelk at Scarborough by William Bean's granddaughter. (Unfortunately the author does not appreciate that there is a difference between "whelk" and "dog-whelk" although they are clearly described by Dance.) He dashes to Scarborough and searches for characters with the surname Bean, all to no avail. The girls are found in the school basement, being held by the (bankrupt) school proprietor. They are in fact discovered by a snappy and disagreeable Scottish terrier owned by one of them, but the girl is quite certain that her clue was a success. The picture, she explains, was mounted on a card bearing the words "Home Sweet Home" and of course the detective realised this indicated they were at the school; it hung over the radiator and therefore he knew they were in the boiler-room. Rather casually, a real sinistral dog-whelk turns up in a sackful of shells and arouses dreams of fame and fortune. The detective's mentally retarded assistant treads on it and reduces it to powder.

In *Housefull of Mussels* by J. van de Wetering, a professor is shot. The police find that his house is a mussel-farm. The suspects are his two girl-friends. One of them regales them with mussels which she is cooking and they find she has hidden her pistol among the mussels in the pot.

In *Vandals*, by P. Lovesey, Miss Parmenter is the sister of a famous potter, now dead. She is visited by the representative of a gallery as she has suggested an exhibition of her sister's pottery. Over a cup of tea he tactlessly pities her for a dull stay-at-home life in contrast with her sister's. Finally he is allowed to see the famous pots. He is speechless. Miss Parmenter has spent years collecting tiny shells from the beach and affixing them to the pots in intricate designs; she proposes they be exhibited as the work of Margaret and Cecily Parmenter. He tells her she has ruined the pots which are no longer works of art, and adds "All I can say is that you must have hated that sister." He turns to go and Miss Parmenter lifts up a vase and cracks his skull.

Columbella, by P. Whitney, could be described as *Jane Eyre* with shells. Transplanted to the Caribbean, it has a young governess who falls in love with her pupil's father; like Jane's employer he is unhappily married. His wife is not as mad as Mrs. Rochester but does have some peculiarities. Christened "Catherine" she insists upon being called "Columbella" and wears an outsize and gilded specimen of this genus on a gold chain round her neck; she also claims to hear voices in a murex shell. If not so mad, she makes up for this by being very very bad. Besides having an ungovernable temper, being unfaithful to her husband, unkind to her daughter and a dabbler in black magic, she is an anti-conservationist as she collects rare shells for a dealer. She also collects common species for herself, sealing into them the jewellery which she has stolen. Finally she is discovered to be a thief, and (as might be expected!) comes to a bad end since she attacks her mother-in-law in a fit of temper and the

old lady defends herself by hitting Columbella with the murex shell which she happens to be holding; this causes Columbella to fall from a balcony to her death.

The Crushing by R. McKie is a novel of Queensland in the 1920's. In it a con-man and thief uses a similar trick, posting loot packed in boxes of shells.

The Cloth of Gold Murders by Baynard Kendrick has a very complicated plot involving conchologists and cones, in which the latter are both objects of value and deadly weapons. A character described as an eccentric marine scientist has purchased a specimen of *Conus gloriamaris* which some of the other characters suspect has been stolen from a museum. Another character is a wealthy shell-collector, so anxious to discover shells not previously recorded from his part of the Florida coast that he has offered $50,000 for a local specimen of *C. gloriamaris*, although experts tell him this is an impossibility. The scientist is murdered and his suspect shell is stolen, together with four live cloth of gold cones (*C. textile*) which he has in an aquarium. The *C. gloriamaris* is made to appear alive (it contains a hermit-crab and moves about in sand) and is duly sold for $50,000 as a live-caught specimen. Two of the deadly cloth of gold cones are used to kill two other characters who may be able to incriminate the murderer; the other two are kept in reserve after having been painted to resemble *C. gloriamaris*. The son of one of the victims traps the murderer; not only does he boil the disguised cones so that yet another prospective victim remains unharmed, but he also adds *Janthinas* to their container so that the murderer's hands are stained with their dye.

Finally, *Glory of the Sea* by W. H. Canaway (not to be confused with *The Glory of the Sea* by Darley Dale). One sometimes wonders whether this cone is really so superlative. It is beautiful and rare and has a glorious name. Collectors treasure it, writers praise it, but is it so very different from all others? Apparently it is. Devon has been idling as a hippy and in an unthinking moment says he will sail round the world on a raft. The resulting publicity makes him carry on although he is not at all enthusiastic. He is tipped off the raft when it hits a reef and is in danger of drowning but grasps a shell and the grasp of a solid object inspires him to struggle ashore on a desert island. The snail has saved his life, so he keeps it carefully in a rock-pool and spends much of his time watching and admiring it. The island, fortunately, is well-provisioned – fish, coconuts and some stores from the raft. Another castaway appears, an elderly Japanese. He has been there for thirty years, the only survivor of an airplane crash, but thinks he is dead and in hell. He imagines Devon is sent to torment him, but they settle down together. Makato collects shellfish to eat and tries to include Devon's special snail, but is warned off. Devon borrows a family sword belonging to the Japanese to cut down a palm tree to make a raft. He breaks the blade, Makato is furious and in revenge seizes the snail. It stings his hand and he drops it back in the pool. He is very ill from its poison but recovers, and decides he is not dead after all and that the snail has saved him from his delusion. The snail dies, but after cleaning the shell the castaways both find it beautiful and mystical; the Japanese says it is *kami*, an aspect of the divine. They make another raft, taking the shell and think it protects them in difficulties. On reaching land the castaways are fêted and much is made of their Miracle Shell. A collector comes to see it, and behold – not only is it a *Conus gloriamaris* but it is the largest ever recorded and it is also sinistral. An Arab sheikh offers two and a half million dollars for it; the offer is refused. The two do not know what to do with it, but finally they decide to take it to a Shinto temple, where it is accepted as a *kami* and taken into the inner sanctuary as an object of devotion. Surely this is the high point of Mollusca in fiction!

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PAINTINGS OF PARALECTOTYPES?: *CONUS* OF THE *MUSEUM LUDOVICAE ULRICAE*

Alan J. Kohn[1]

(*Accepted for publication, 20th October, 1990*)

Abstract: In the early 1750's, Linnaeus commissioned paintings of 450 gastropod shells from the museum of Queen Louisa Ulrica. Rendered by H. C. von Krus, they were intended to illustrate Linnaeus's catalogue of this collection, but this was published without plates and the paintings have been nearly forgotten. They are preserved in the Royal Swedish Academy of Sciences. Many of the shells that served as models for the paintings, including 18 of *Conus*, are still preserved in the *Museum Louisa Ulricae* collection in the University of Uppsala. They afford new insights into Linnaeus's concept of several of the species he proposed. Whether or not these specimens should be considered members of the type series of Linnaean species depends on interpretation of an ambiguous section of the International Code of Zoological Nomenclature.

INTRODUCTION

Over the past century, several authors (Lovén 1887, Dodge 1952, 1959, Löwegren 1959, Hollister 1958, Dance 1967) have noted the existence of paintings commissioned by Linnaeus to illustrate his catalogue of Queen Louisa Ulrica's natural history collection (Linnaeus 1764). It is not widely known, however, that these unpublished paintings quite faithfully depict particular specimens, and that some of these remain preserved in the Zoological Institute of the University of Uppsala (ZIUU).

Of the 415 figures of gastropods, painted on 40 quarto leaves of velum by Herman Conrad von Krus (1720–1787), 45 are of specimens of *Conus*. Here I report on an examination of these paintings and the specimens they depict that are still preserved in Uppsala. One of these has been regarded as the holotype of *C. princeps* Linnaeus. I address the question as to whether or not the others should be considered paralectotypes of Linnaean species, and I show that they afford new insights into Linnaeus's concept of a number of the species he described.

In this report, MLU indicates the museum of Queen Louisa Ulrica in the ZIUU, Linnaeus's (1764) catalogue of the collection is referred to as the *Museum Ulricae*, and *Systema* indicates the 10th edition of the *Systema Naturae* (Linnaeus 1758) except where otherwise noted.

HISTORY

As pointed out by Lovén (1887, from which most of this account is summarized), the middle years of the 18th century marked an important epoch in the life of Carolus Linnaeus (Karl von Linné, 1707–1778). The rapidly evolving *Systema Naturae* was in its sixth edition (1748), he published the *Philosophia Botanica* in 1751, and the *Species Plantarum*, which introduced binomial nomenclature in its final form, in 1753.

Also in 1751, Adolphus Frederic and Louisa Ulrica ascended to the Swedish throne, and

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both immediately established natural history museums. The King's museum, at Ulrikdal, emphasized vertebrates, while the Queen's, in her Drottningholm palace, comprised invertebrates, principally insects, crustacea, shells, echinoderms and corals, largely purchased at the sales of pre-existing collections abroad. Linnaeus was commissioned to curate both royal collections and to prepare illustrated descriptive catalogues of them.

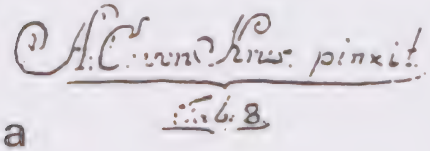
Linnaeus began work on the Queen's collection at Drottningholm early in July, 1751, when he was 43 years of age. He stayed until the first week in September, and then returned to work for shorter periods later in the year and on several occasions in 1752, 1754, and early 1755. The dates of these visits are quite precisely known, largely from Linnaeus's extensive correspondence with his closest friend Abraham Bäck (1713–1795), a noted medical doctor in Stockholm. The most important working periods at Drottningholm were the 13 weeks in 1751 and 1752 during which Linnaeus wrote the manuscript of the *Museum Ludovicae Ulricae* 'in all its essential parts' (Lovén 1887). The text was ready for publication in 1754.

Linnaeus's development of binomial nomenclature was culminating at the same time, as noted above. He established it firmly in the *Species Plantarum* in 1753 and in the *Museum Adolphi Friderici* in 1754. For the first time he placed trivial names in the margin opposite the diagnosis, as he would do in the 10th edition of the *Systema* and the *Museum Ulricae*. As Linnaeus worked on the Queen's collections, he incorporated the results into his lectures at the University of Uppsala. In 1752, he lectured on the Testacea and in these lectures gave some gastropod groups (e.g. *Cypraea*, *Bulla*) all binominal species names. In others (e.g. *Murex*, *Trochus*), some names were binominal and others were vernacular; in *Conus*, most species did not receive binominal names (Lovén 1887). By the time Linnaeus completed the *Museum Ulricae* manuscript in 1754, he was applying the binominal system throughout the Testacea as well as other animal groups. This manuscript, however, lay unpublished until 1764, and in 1756 and 1757 Linnaeus prepared the manuscript for the 10th edition of the *Systema*, the first publication (Linnaeus 1758) to apply binominal nomenclature consistently throughout the animal kingdom. During this preparation, he introduced all of the new species described in the *Museum Ulricae* manuscript into the *Systema* (Lovén 1887).

To return to the *Museum Ulricae*, in a letter to Bäck of 8 September 1752, Linnaeus expressed concern about finding appropriate draftsmen and engravers for the illustrations for both it and the *Museum Adolphi Friderici*. By 1753, however, the artists had been contracted and the paintings were being prepared, apparently mainly in Stockholm according to the correspondence of Linnaeus and Bäck.

In all, 450 gastropods were drawn, including 35 figures on two folio leaves by Nicolas Lafrensen in addition to the 415 mentioned above by von Krus. According to Lovén (1887), von Krus was 'an officer who had served with distinction in foreign armies.' (Lovén (1887) spells the name 'von Kruus,' but the plates are signed 'H. C. von Krus' (Fig. 1a) and I follow that usage.) Von Krus numbered all and dated some of his plates, and approximate dates may be interpolated for the others. The earliest date, February, 1754, is on the 15th plate, other plates through no. 34 are dated through November, 1754, and the last two, nos. 39 and 40, are dated February, 1755.

The four plates illustrating shells of *Conus* are numbered VII, 8, IX, and X. According to the chronology given above, they must have been completed prior to February, 1754. No key or legends to the plates are known, but each illustration is numbered. The numbers appear to be in the hand of von Krus, judging by the similarity in the number '8' in the designation of shells and on the label of Plate 8 (Fig. 1b). The existence of these numbers on the plates renders puzzling the statement of Lovén (1887, p. 39), based on letters of Linnaeus to Bäck of 31 December 1754 and 12 February 1755, that 'at the close of the year 1754 Linnaeus requests to have sent to him for numeration the figures then made by von Kruus, but it does not appear that he had them.' Dodge (1952, p. 16) perpetuated this view, but he likely based it on the statement of Lovén (1887).



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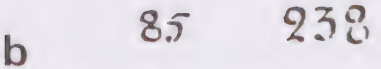

b

Figure 1a. Signature of Herman Conrad von Krus. Reproduced from the eighth of 40 plates he painted of gastropod shells in the *Museum Ludovicae Ulricae*. b. Samples of numbers from two von Krus paintings. The similarity of the '8' between these and the plate number in Fig. 1a indicates that von Krus numbered the illustrations of each specimen.

Thus both text and plates, at least those of the gastropods, of the *Museum Ulricae* were completed by early in 1755, well before Linnaeus completed the manuscript of the tenth edition of the *Systema Naturae* (Lovén, 1887). However, it was to be another decade before the text of the *Museum Ulricae* was published. The plates were never published due to shortage of funds, but the original paintings remain carefully preserved in the library of the Royal Swedish Academy of Sciences in Stockholm.

In 1770, possession of the Queen's collection passed to her son Gustavus III, and in the following year after the death of King Adolphus Frederic his museum was also moved to Drottningholm. In 1789, the eminent botanist Olaus Swartz became informal curator of the royal collections. He pasted printed labels, probably cut from a copy of the 12th edition of the *Systema*, on the shells. As indicated below and in Kohn (1963), many of these labels are still in place. The fact that Swartz mislabeled some specimens (e.g. *C. glaucus*, *q.v.* below) suggests that he was unaware of the numbered paintings of von Krus.

In 1792, Gustavus Adolphus IV succeeded to the throne, and in 1803 he donated his grandmother's museum to the University of Uppsala. Professor C. P. Thunberg supervised the transfer of the collection from Drottningham to the museum in the botanic garden at Uppsala. Thunberg also curated the shells, placing pencilled labels that repeated Swartz's identifications with the specimens. Many of these also remain in the MLU collection, which is today preserved in the ZIUU.

CONCORDANCE OF THE PLATES, THE TEXT, AND THE SPECIMENS IN THE *MUSEUM LUDOVICAE ULRICAE*

The numbers of the shells on the plates of *Conus* do not conform with the numbers of species in the *Museum Ulricae* (Linnaeus 1764), but they are related, as Tables 1 and 2 indicate. The numbers of most of the illustrations are greater by 70 than the corresponding number of the species in the *Museum Ulricae*. Others differ by 69 or 72 (Table 2). The discrepancy suggests that Linnaeus may have altered the order of appearance of genera in the *Museum Ulricae* between 1755 and its publication.

The numbers on the von Krus plates do correspond to those Linnaeus entered in one of his draft manuscripts of the *Museum Ulricae*, and also with those marked, presumably by Linnaeus or an assistant, in his copy of d'Argenville's *l'Histoire Naturelle . . . Conchyliologie* (1742). These are both preserved in the Linnean Socity of London. In the latter work, Linnaeus identified the illustrations by writing his own species name and d'Argenville's

TABLE 1

Summary of the correspondence and discrepancies between numbers of species in the *Museum Ulricae* and numbers of the von Krus paintings of *Conus*.

Museum Ulricae Numbers	Von Krus Painting Numbers	Notes
151–153	221–223	
154		not illustrated
155–157	224–226	
	227	not in *Museum Ulricae*
158–169	228–239	
	240–241	not in *Museum Ulricae*
170–174	242–246	+ a second No. 245
175		not illustrated
176–177	Both No. 247	+ a third No. 247
178		not illustrated

letter designation of the figure in the margin of each plate. On the plate itself, numbers that correspond to the von Krus painting numbers are entered just under each shell. Dance (1967) illustrated a portion of Plate 15 in Linnaeus's copy of d'Argenville (1742). Table 2 indicates the concordance of the numbers on the von Krus paintings, Linnaeus's copy of d'Argenville (1742), and his draft and published versions of the *Museum Ulricae*.

Von Krus's *en gouache* illustrations are quite accurately rendered with respect to shell size, pattern and colour, and most specimens are individually recognizable. Some of these specimens remain preserved in the MLU collection at Uppsala. Like the other specimens in the Queen's collection, Linnaeus did not label or individually identify them (Dodge 1959). The names he applied to these specimens are, however, readily determined by following the numbers from the von Krus plates through the Argenville plates to Linnaeus's identification in the margins of the latter. Plates 1 and 2 reproduce the von Krus illustrations and provide photographs of the 18 *Conus* specimens that I could identify with them during my visit to Uppsala in August, 1989.

ARE *MLU* SPECIMENS MEMBERS OF THE TYPE SERIES OF LINNAEAN SPECIES?

The definition of the 'type series' in the *Code* of the International Commission on Zoological Nomenclature (ICZN 1985), Art. 72, is ambiguous. In Art. 72a(i), the type series is defined as including 'all the specimens . . . on which the author established a nominal species-group taxon.' However, the definition in Art. 72b(i) differs: 'The type series of a nominal species-group taxon consists of all the specimens eligible to the name-bearing types [Sect. c] included by the author in the new nominal taxon . . .' Section c deals only with specimens, parts of animals, fossils, prepared slides, etc. that qualify as types and is not relevant here. The glossary of the *Code* (ICZN 1985, p. 270) defines type series as 'the series of specimens, defined in Articles 72b(i) and 73b . . .' It does not refer at all to Art. 72a. The language of section b(i) of Art. 72 appears to define membership in the type series more liberally than that of section a(i). That is, the term 'included by the author in the new nominal taxon' implies, to this writer at least, that any specimen the original author had identified as belonging to the taxon at the time of its description is a member of its type series. Clearly an author may identify specimens, other than those on which he established the new nominal taxon, as being included in that taxon.

Recommendation 72B of the *Code* admits external evidence in determining membership in the type series: 'If an author, in establishing a nominal species-group taxon, does not explicitly state what specimens constitute the type series, evidence in addition to published evidence may be taken into account (e.g., labels by the original author and specimens known to have been in appropriate collections at the appropriate time.')

Thus for species described by Linnaeus (1758), Art. 72a would include in the type series only specimens referred to in the original description. In contrast, Art. 72b and Rec. 72B would also include in the type series specimens that Linnaeus identified as belonging to the nominal species but did not explicitly mention in the description.

As we know that Linnaeus studied and selected the specimens illustrated by von Krus in 1751–1754, prior to his completion and publication of the tenth edition of the *Systema Naturae*, should they be considered as members of the type series of species described by him in 1758? Even though Linnaeus did not individually label these specimens, identification via the numbering system described above provides appropriate external evidence of the type allowed by Rec. 72B. This permits us to determine the names of the species to which Linnaeus assigned these specimens in 1754. These are the species names in the *Museum Ulricae*, and I list them in Table 2. These specimens clearly conform to the definition of the type of series in Art. 72b. But since Linnaeus (1758), with one exception (*C. princeps*), did not use the MLU specimens when he 'established a nominal species-group taxon' in the 10th edition of the *Systema*, the specimens just as clearly do not meet the criterion of the type series in Art. 72a.

An additional complicating factor is that Linnaeus's concepts of some species apparently changed between his completion of the text of the *Museum Ulricae* in 1754 and completion of the 10th edition of the *Systema*. Linnaeus's treatment of species was not always consistent between the two works, even though his descriptions in the *Museum Ulricae* are more accurate and more comprehensive than those in the *Systema Naturae*, as Dodge (1959) noted. While some do help to identify specimens as well as species, others refer to more than one species or to different species from the *Systema*. Since the 10th edition of the *Systema* was published first although it was written later, its names of course have priority over those in the *Museum Ulricae*.

Kohn (1963, in press) designated lectotypes of 21 *Conus* species described by Linnaeus in the *Systema*. If the term type series is defined according to Art. 72b, Rec. 72B, and as the Glossary of the *Code* instructs, the MLU specimens of these species painted by von Krus, and with which Linnaeus associated his own binominal names in writing in his copy of Argenville (1742), qualify as paralectotypes. If type series is defined according to Art. 72a, they do not. Until this ambiguity is resolved by the ICZN, it may be prudent not to consider these specimens as paralectotypes, but to use them to the extent possible in determining Linnaeus's concept of the species he described.

SUMMARY AND STATUS OF THE SPECIMENS OF *CONUS* PRESENT IN THE MLU COLLECTION

In this section I discuss and illustrate the MLU specimens of *Conus* painted by von Krus that remain in the collection of the ZIUU. The species are taken up alphabetically according to their presently accepted names.

Conus ammiralis Linnaeus

Von Krus painted two MLU specimens of *C. ammiralis*, nos. 226b and 226c on Pl. IX, that are present in the ZIUU. These probably represent varieties β (*C. a. ordinarius*) (Pl. 1, Figs. 1–3) and γ (*C. a. occidentalis*) (Figs. 4–6), respectively, as the descriptions in Linnaeus (1764)

TABLE 2

Concordance of the von Krus plates of *Conus* with Linnaeus's numbers in his copy of d'Argenville (1742) and in the draft and published versions of the *Museum Ulricae*

Painting Number	Linnaeus's copy of d'Argenville (1742) Plate: Fig.	Linnaeus Number	*Museum Ulricae* Number draft	published	Species Name Published In *Museum Ulricae*	Variety	Present Species Name if different (Notes)	Figure numbers on Plate 1 and 2
221	15:O	221	221	151	*marmoreus*			—
222	15:F	222	222	152	*imperialis*			27–29
223	15:I	223	223	153	*litteratus*	α		30–32
223	15:I	223	223	153	*litteratus*	β	*spurius* Gmelin?	—
223	15:I	223	223	153	*litteratus*	γ	*spurius* Gmelin?	—
223	15:I	223	223	153	*litteratus*	δ	(+3 more vars. not illustrated)	
				154	*virgo*		(not illustrated)	—
224	15:K	224	224	155	*capitaneus*	α	*miles* L.	—
224	15:K	224	224	155	*capitaneus*	β		—
224	15:K	224	224	155	*capitaneus*	γ	*litoglyphus* Hwass	—
224	15:K	224	224	155	*capitaneus*	δ	*generalis* L.	—
224	15:K	224	224	155	*capitaneus*	?	*spurius* Gmelin?	—
225			225	156	*princeps*		(holotype)	51–53
226							*zebra* Lamarck	—
226a				157	*ammiralis*	α	*aurisiacus* L.	—
226b	15:H, N	226	226	157	*ammiralis*	β		1–3
226c	15:H, N	226	226	157	*ammiralis*	γ		4–6
227			227				*cedonulli* L.	12–14
228	15:M	228	238*	158	*nobilis*			39–41
229			229	159	*genuanus*			
230			230	160	*glaucus*			21–23
231			231	161	*monachus*			36–38
232			232	162	*minimus*		*achatinus* Gmelin	—
233				163	*rusticus*		*catus* Hwass	—

Table 2 *Continued.*

Painting Number	Linnaeus's copy of d'Argenville (1742) Plate: Fig.	Linnaeus Number	*Museum Ulricae* Number draft	*Museum Ulricae* Number published	Species Name Published In *Museum Ulricae*	Variety	Present Species Name if different (Notes)	Figure numbers on Plate 1 and 2
233	15:D	233	233	163	*rusticus*		*C.* sp.	
234	15:P	234	234	164	*mercator*			33–35
235			235	165	*betulinus*			9–11
236			236	166	*figulinus*			18–20
237	15:G	237	237	167	*ebraeus*			15–17
237							?	
238	15:S	238	238	168	*stercusmuscarum*		*arenatus* Hwass	—
239			239	169	*varius*			—
239	15:R	239	239	169	*varius*		*aurantius* Hwass	—
240			240				*terebra* Born	—
241			241				*nussatella* L.	42–44?
242			242	170	*granulatus*			24–26
243			243	171	*magus*			—
244	16:C	244	244	172	*striatus*			
245	16:I	245	245	173	*textile*			—
245	16:D	245**	245	173	*textile*		*auricomus* Hwass	7–8
246			246	174	*aulicus*		*omaria* Hwass	45–47
247			248	176	*bullatus*			—
247							*tulipa* L.	—
				178	*terebellum*		(not illustrated)	
248			247	175	*spectrum*		cf. *spectrum*	48–50
248							*pulcher* [Lightfoot]	
249	16:A	249	249	177	*geographus*			—

*, error for 228; **, d'Argenville figure is of *C. aulicus*.

apply closely to these specimens. The lectotype of *C. ammiralis* designated from the Linnaean collection in the Linnean Society of London (Kohn 1963) is conspecific with the MLU specimens of *C. ammiralis* Linnaeus, 1758.

Conus auricomus Hwass in Bruguière

The species described as *Conus auricomus* Hwass in Bruguière, 1792 was evidently a source of considerable confusion to Linnaeus. In the *Systema*, it is likely that this is one of two species Linnaeus confused under the name *C. clavus* (Kohn, 1963), a name now suppressed by ICZN Opinion 753 and on the Official Index of Rejected Names in Zoology (ICZN 1987). In the *Museum Ulricae*, Linnaeus confused this species with *C. textile*. Both the subdescription under the entry for that species and the von Krus painting (Pl. VII, fig. 245) apply to *C. auricomus*. The von Krus illustration and the MLU specimen are shown in Figs. 7–8. Although Linnaeus identified the specimen as *C. textile* Linnaeus, it is not conspecific with the lectotype of that species in the Linnean Society of London.

Conus betulinus Linnaeus

This species is represented in the MLU collection by the specimen illustrated by von Krus on Pl. 8, no. 235 (Figs. 9–11). It is conspecific with the lectotype of *C. betulinus* Linnaeus, 1758 in the Linnean Society of London.

Conus cedonulli Linnaeus

Originally described as *Conus ammiralis cedonulli* by Linnaeus (1767) in the 12th edition of the *Systema*, this species-group name does not appear in the *Museum Ulricae*. However, von Krus figured a specimen of this species (Pl. IX, no. 227) that is preserved in the MLU collection (Figs. 12–14). Its number does not correspond with any *Museum Ulricae* number (it would have been between nos. 157 and 158) and this discrepancy changes the difference between von Krus's numbers and *Museum Ulricae* numbers from 69 to 70 (Table 2). The MLU specimen is conspecific with the representation of the lectotype of *C. cedonulli* Linnaeus, 1758, but there is no evidence that Linnaeus associated that name with it.

Conus ebraeus Linnaeus

Von Krus painted a specimen on Pl. IX, no. 237 (Fig. 15) that is present in the MLU collection (Figs. 16, 17). It is conspecific with the lectotype of *C. ebraeus* Linnaeus, 1758 in the Linnean Society of London.

Conus figulinus Linnaeus

The smaller of two specimens in the MLU collection was illustrated by von Krus (Pl. 8, no. 236) (Fig. 18). The specimen retains a printed Swartz label (Figs. 19, 20) and is accompanied by a pencilled Thunberg label. It is conspecific with the lectotype of *C. figulinus* Linnaeus, 1758 in the Linnean Society of London.

Conus glaucus Linnaeus

The MLU specimen, mislabelled *C. rusticus* by Swartz (see Kohn 1963, Pl. II, fig. 17) was figured by von Krus (Pl. 8, no. 230) (Fig. 21). Figs. 22 and 23 show the MLU specimen in 1989, with part of the Swartz label missing. The description of *C. glaucus* in the *Museum Ulricae* is more accurate and more detailed than that in the *Systema* and it helps to identify the species unequivocally. Kohn (1963) designated a figure cited by Linnaeus (1758) as representation of the lectotype of *C. glaucus* Linnaeus, 1758; the MLU specimen is conspecific with the lectotype.

Conus granulatus Linnaeus
Von Krus (Pl. VII, no. 242) illustrated a specimen preserved in the MLU (Figs. 24–26); it retains a portion of the Swartz label. This specimen is conspecific with the lectotype of *C. granulatus* Linnaeus, 1758 in the Linnean Society of London.

Conus imperialis Linnaeus
The specimen illustrated by von Krus (Pl. IX, no. 222) is preserved in the MLU collection (Figs. 27–29). It is conspecific with the lectotype of *C. imperialis* Linnaeus, 1758 in the Linnean Society of London.

Conus litteratus Linnaeus
Von Krus gave the number 223 to four illustrations in a row on Pl. 8. Of these, only the specimen on the left is present in the MLU collection (Figs. 30–32). It is probably the specimen of *C. litteratus* var. α of Linnaeus (1764). This specimen is conspecific with the lectotype of *C. litteratus* Linnaeus, 1758 in the Linnean Society of London.

Conus mercator Linnaeus
A specimen in the MLU collection bearing a Swartz label and accompanied by a Thunberg label was figured by von Krus on Pl. VII, no. 234 (Figs. 33–35). It is conspecific with the lectotype of *C. mercator* Linnaeus, 1758 in the Linnean Society of London.

Conus monachus Linnaeus
Von Krus illustrated a specimen in the MLU collection (Pl. VII, no. 231) (Figs. 36–38) that likely is the basis for the subdescription Linnaeus (1764) added in the *Museum Ulricae*. Kohn (1963) designated a figure in Buonanni (1684) cited by Linnaeus (1758) as representation of the lectotype. The MLU specimen is conspecific with the lectotype of *C. monachus* Linnaeus, 1758.

Conus nobilis Linnaeus
The MLU contains the specimen figured by von Krus (Pl. IX, no. 228) (Figs. 39–41). It is conspecific with the lectotype of *C. nobilis* Linnaeus, 1758 in the Linnean Society of London.

Conus nussatella Linnaeus
Linnaeus (1764) did not mention this species in the *Museum Ulricae*, although von Krus illustrated a specimen on Pl. VII, no. 241 that may be present in the MLU (Figs. 42–44); if this association of specimen and figure is correct, the figure is not as faithfully rendered as those of other specimens. As indicated in Table 2, there is no citation of the equivalent species number (it would had to have been between 169 and 170) in the *Museum Ulricae*. The MLU specimen is conspecific with the lectotype of *C. nussatella* Linnaeus, 1758 in the Linnean Society of London.

Conus omaria Hwass in Bruguière
Under *C. aulicus* Linnaeus in the *Museum Ulricae*, Linnaeus (1764) added a description that applies not to that species of the *Systema* (Linnaeus, 1758) but to a specimen of the species later described as *Conus omaria* Hwass in Bruguière, 1792. Von Krus illustrated this specimen, presently in the MLU collection, in Pl. VII, no. 246 (Figs. 45–47). It is not conspecific with the lectotype of *C. aulicus* Linnaeus, 1758, but Linnaeus likely confused the two species.

Conus sp. cf. *C. spectrum* Linnaeus
The specimen illustrated by von Krus on Pl. VII, no. 248 is present in the MLU collection, (Figs. 48–50) but I cannot identify it to species with certainty.

Conus princeps Linnaeus
This is the only Linnaean species of which the MLU specimen is the holotype (Kohn 1963) (Figs. 52–53). Linnaeus (1758) explicitly referred exclusively to the MLU specimen in the original description. Von Krus illustrated the holotype on Pl. IX, fig, 225 (Fig. 51).

In summary of this section, among the 45 original MLU specimens of *Conus* painted by von Krus, 18 are presently preserved in the ZIUU. Linnaeus's manuscripts clearly indicate that he identified all but two of these specimens (*C. cedonulli* and *C. nussatella*) with species he described in the tenth and twelfth editions of the *Systema Naturae*. Thirteen of the identified specimens belong to 9 species (*C. ammiralis* (2), *C. betulinus*, *C. ebraeus*, *C. figulinus*, *C. granulatus*, *C. imperialis*, *C. litteratus*, *C. mercator*, *C. nobilis*) for which lectotypes have been designated from Linnaeus's own collection in the LSL and 3 species (*C. glaucus*, *C. monachus*, *C. spectrum*) for which representations of lectotypes were designated (Kohn 1963). One specimen is the holotype of *C. princeps* Linnaeus, and the remaining two, of *C. auricomus* Hwass and *C. omaria* Hwass, belong to species other than those to which Linnaeus (ms.) assigned them (*C. textile* and *C. aulicus*, respectively).

DISCUSSION AND CONCLUSIONS

In the early 1750's, Linnaeus commissioned Herman Conrad von Krus to render illustrations of more than 400 gastropod shells from the collection of the then Queen of Sweden, Louisa Ulrica. These were to serve as originals of plates that would illustrate a published catalogue of her museum. The catalogue was ultimately published (Linnaeus 1764) but the illustrations were not. The original paintings remain preserved in the Royal Swedish Academy of Sciences in Stockholm. Each shell is numbered on the paintings in the hand of the artist. The numbers correspond to those written by Linnaeus or an assistant in his own copy of Argenville (1742). Because Linnaeus wrote his trivial name for the species depicted in Argenville's illustration in the margin of the plates, the name Linnaeus intended

PLATE 1 (Opposite)

Figs. 1–6. *Conus ammiralis* Linnaeus. Fig. 1. Reproduction of von Krus Pl. IX, fig. 226b, *C. a. ordinarius* Linnaeus, or Var. β of the *Museum Ulricae* 55 × 26 mm. Figs. 2, 3. MLU specimen 54 × 28 mm. Fig. 4. Reproduction of von Krus Pl. IX, fig. 226c, *C. a. occidentalis* Linnaeus, or Var. γ of the *Museum Ulricae* 52 × 23 mm. Figs. 5, 6. MLU specimen 48 × 26 mm.
Figs. 7–8. *Conus auricomus* Hwass in Bruguiére. Fig. 7. Reproduction of von Krus Pl. VII, fig. 245, *C. textile* Linnaeus, of the *Museum Ulricae* 46 × 15 mm. Fig. 8. MLU specimen. 44 × 15.5 mm.
Figs. 9–11. *Conus betulinus* Linnaeus. Fig. 9. Reproduction of von Krus Pl. 8, fig. 235, 63 × 38 mm. Figs. 10, 11. MLU specimen. 63 × 39 mm.
Figs. 12–14. *Conus cedonulli* Linnaeus. Fig. 12. Reproduction of von Krus Pl. IX, fig. 227. 51 × 28 mm. Figs. 13, 14. MLU specimen. 46 × 26 mm.
Figs. 15–7. *Conus ebraeus* Linnaeus. Fig. 15. Reproduction of von Krus Pl. IX, fig. 237. 35 × 22 mm. Figs. 16, 17. MLU specimen. 33 × 21 mm.
Figs. 18–20. *Conus figulinus* Linnaeus. Fig. 18. Reproduction of von Krus Pl. IX, fig. 236. 65 × 37 mm. Figs. 19, 20. MLU specimen. 59 × 38 mm.
Figs. 21–23. *Conus glaucus* Linnaeus. Fig. 21. Reproduction of von Krus Pl. 8, fig. 230. 47 × 26 mm. Figs. 22, 23. MLU specimen. 45 × 29 mm.

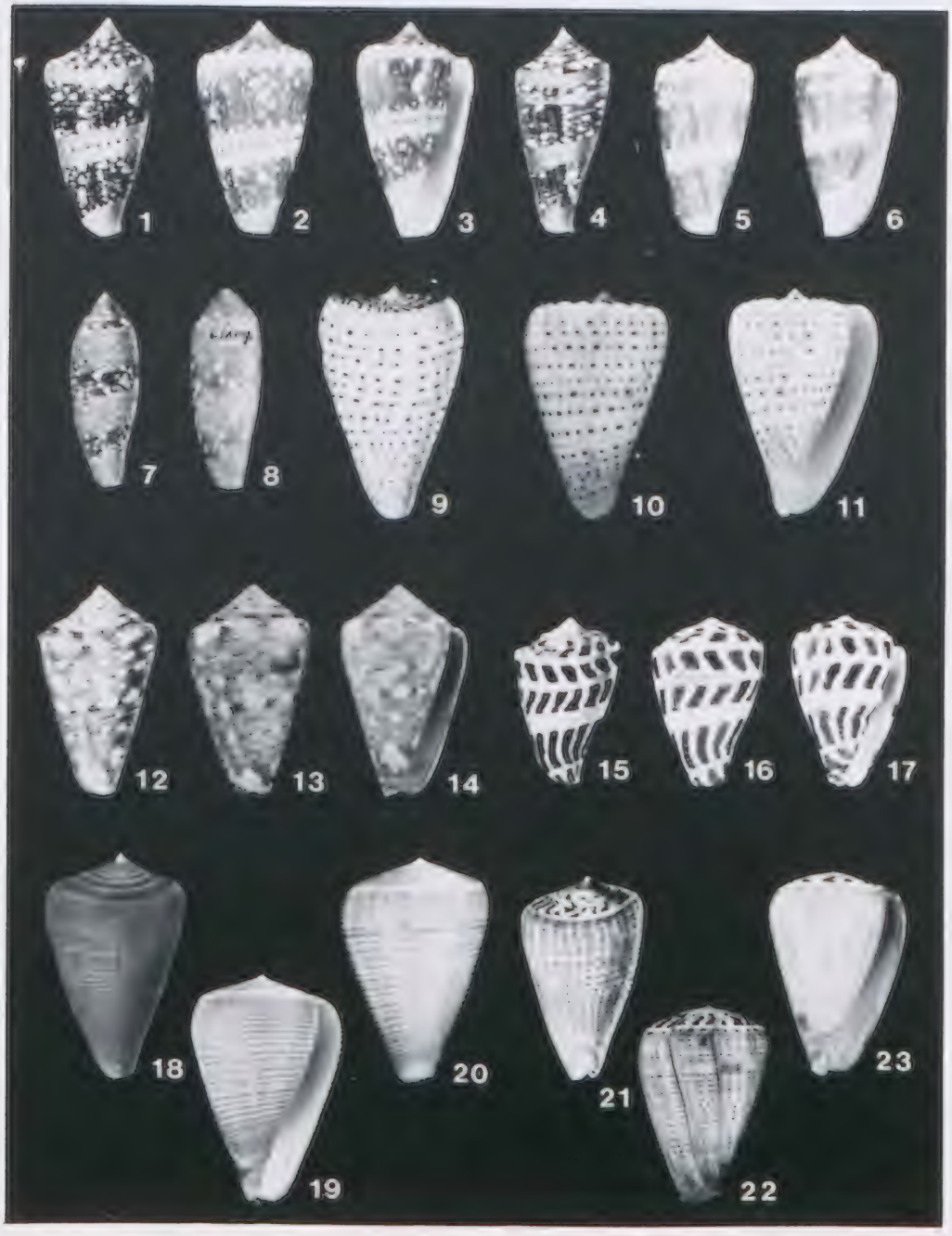

PLATE 1


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PLATE 2

to apply to the specimens illustrated in von Krus's paintings can be traced from the name he wrote in the margin of Argenville's plate, to the individual Argenville figure, to the hand-written number just under the figure, to the von Krus painting. This concordance, and that of Linnaeus's numbers in his ms. of the *Museum Ulricae* with those of the von Krus paintings, has permitted determination of Linnaeus's names for 89% (40/45) of the illustrations of *Conus*.

Of the 45 specimens of *Conus* von Krus painted, 18 are present in the MLU collection in Uppsala. I discovered 10 of these in 1989; the other 8 were known previously (Kohn, 1963). One of the latter is the holotype of *C. princeps* Linnaeus. In his manuscripts, Linnaeus clearly identified 10 of the 18 specimens as belonging to 13 species (listed in the previous section), that he later described in the *Systema* and for which I had earlier selected lectotypes or representations of lectotypes (Kohn 1963). Thus, none of these specimens qualify as lectotypes. Whether or not they should be considered paralectotypes is uncertain, because of an ambiguity in Article 72 of the International Code of Zoological Nomenclature. However, they contribute additional insights to Linnaeus's concepts of a number of the species he described.

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PLATE 2 (Opposite)

Figs. 24–26. *Conus granulatus* Linnaeus. Fig. 24. Reproduction of von Krus Pl. VII, fig. 242. 43 × 19 mm. Figs. 25, 26. MLU specimen. 42 × 19.5 mm.
Figs. 27–29. *Conus imperialis* Linnaeus. Fig. 27. Reproduction of von Krus Pl. IX, fig. 222. 63 × 31 mm. Figs. 28, 29. MLU specimen. 62 × 31 mm.
Figs. 30–32. *Conus litteratus* Linnaeus. Fig. 30. Reproduction of von Krus Pl. 8, fig. 223. 64 × 35 mm. Figs. 31, 32. MLU specimen. 65 × 37 mm.
Figs. 33–35. *Conus mercator* Linnaeus. Fig. 33. Reproduction of von Krus Pl. VII, fig. 234. 28 × 16 mm. Figs. 34, 35. MLU specimen. 27.5 × 15.5 mm.
Figs. 36–38. *Conus monachus* Linnaeus. Fig. 36. Reproduction of von Krus Pl. VII, fig. 231. 40 × 20 mm. Figs. 37, 38. MLU specimen. 39.5 × 20.5 mm.
Figs. 39–41. *Conus nobilis* Linnaeus. Fig. 39. Reproduction of von Krus Pl. IX, fig. 228. 52 × 24 mm. Figs. 40, 41. MLU specimen. 51 × 24 mm.
Figs. 42–44. *Conus nussatella* Linnaeus. Fig. 42. Reproduction of von Krus Pl. VII, fig. 241. 50 × 18 mm. Figs. 43, 44. MLU specimen. 49 × 17 mm.
Figs. 45–47. *Conus omaria* Hwass in Bruguiére. Fig. 45. Reproduction of von Krus Pl. VII, fig. 246. 62 × 26 mm. Figs. 46, 47. MLU specimen. 62 × 31 mm.
Figs. 48–50. *Conus* sp. cf. *C. spectrum* Linnaeus. Fig. 48. Reproduction of von Krus Pl. VII, fig. 248. 48 × 25 mm. Figs. 49, 50. MLU specimen. 47 × 26 mm.
Figs. 51–53. *Conus princeps* Linnaeus. Fig. 51. Reproduction of von Krus Pl. IX, fig. 225. 54 × 30 mm. Figs. 52, 53. Holotype in MLU. 51 × 30 mm.

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J. Conch. **34:** 19–29 (1991)

GEOMALACUS MALAGENSIS SP.N. AND SOME REMARKS CONCERNING GENERIC LEVEL SYSTEMATICS OF ARIONIDAE (GASTROPODA:PULMONATA)

Andrzej Wiktor[1] and Adrian Norris[2]

(*Accepted for publication, 20th October 1990*)

Abstract: A description of a new species of slug, resembling in external appearance *Letourneuxia numidica* Bourguignat, 1866, is recorded from the southern part of the Iberian Peninsula. The internal structure has led the authors to put forward a new set of diagnostic features for genera within the Arionidae.

Many recent investigations of the slugs of the Iberian Peninsula have thrown up records of new species on an almost annual basis, thus showing that the slug fauna of that region of Europe is not sufficiently known, as yet. At the same time, it has been generally acknowledged that the area abounds in a great variety of arionids. Unfortunately, we do not know for certain whether the whole family originated in the region, as Likharev & Wiktor (1980) suggest. The chances are, that, during the Quaternary it might have been the distribution centre from which the Arionidae spread out to vast areas of the Palearctic.

Most of the endemic species of arionid occur in that region. Similarly, nearly all the taxa at generic level are represented there, or in the adjoining regions of North Africa. The newly discovered species, however, demonstrates that the current system of generic classification is deficient and needs to be corrected. These refinements can only be carried out after a more thorough study of the Arionidae in the Iberian Peninsula and north-west Africa. In this paper we would like to record our knowledge in this problem area, but do not propose any major changes to the system as a whole.

Geomalacus malagensis sp. n.
Arion (Letourneuxia) moreleti sensu Norris 1977; p. 169 Fig. 1.
Holotype: Colmenar, NW of Malaga, Prov. Malaga, Spain, in a dry, rotten *Pinus halepensis* trunk, leg. E. Bylińska 25–3–1981 (Museum of Natural History, Wrocław University, Wrocław, Poland, No. MP 613).

Paratypes: 1 specimen collected with holotype (Mus. Nat. Hist. Wrocław); Benaocaz, Prov. Cádiz, Spain, UTM 30TTF8464, Leg. A. I. Puente & K. Altonaga, 5–10–1989, – 1 specimen (in private collection R. Martin, Bilbao, Spain); Vejar, Prov. Cádiz, Spain, UTM 31TTF01, Leg. A. J. Puente & K. Altonaga, 5–10–1989 – 1 specimen (in private collection R. Martin, Bilbao, Spain); W. Algericas, S. Sierra del Mino, Prov. Cadiz, Spain, 250 m., Leg. Grimm & Rachinsky, 5–10–1984, – 1 juv. specimen, (in private collection W. Rähle, Tübingen, F. R. G.); Gibraltar, Leg. A. Norris, 5–1975, 1 adult 1 juv. (Leeds City Museum, Leeds, No. LEEDM–C–9–1989). 1 adult, 1 juv. (A. Norris, private collection); Gibraltar leg. A. Menez, 5–1987 2 specimens private collection A. Norris, Leeds; Gibraltar, UTM TF885501 26,

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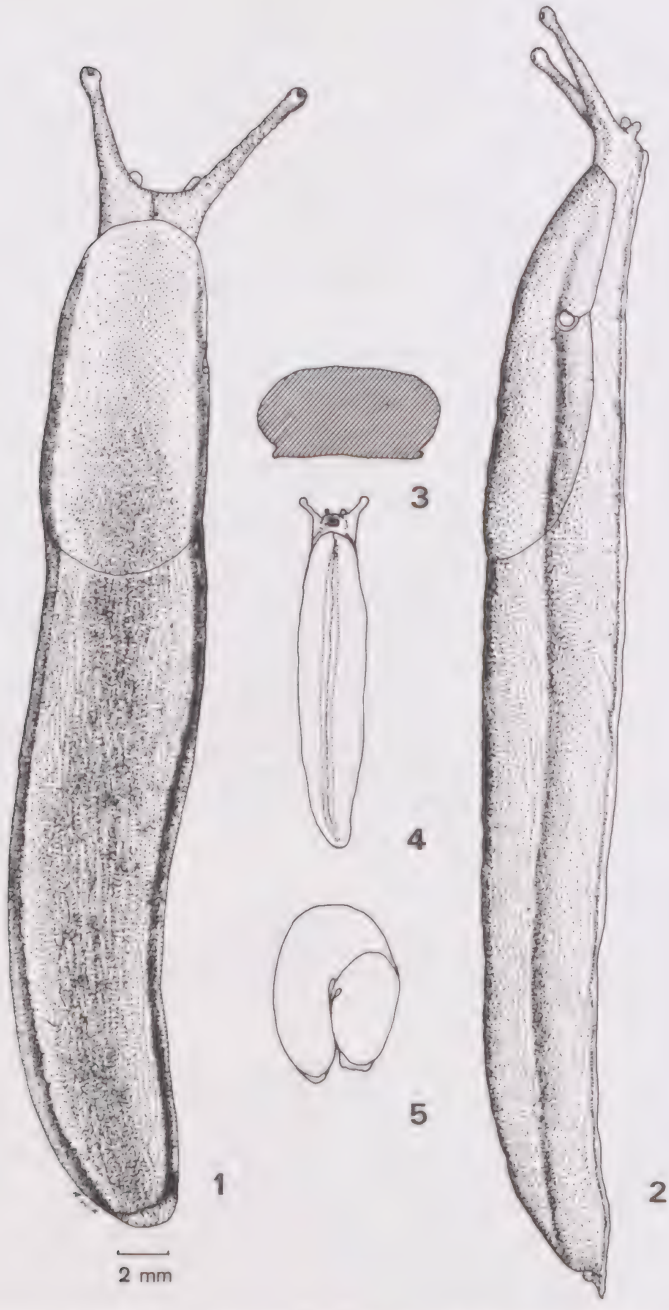


Figs. 1–5. *Geomalacus malagensis* sp.n. 1–2 paratype from Gibraltar, top and side view. Figure made on the basis of a live laboratory reared specimen. 3 – Cross-section through body. 4 – Appearance of sole. 5 – C shaped resting position, occasionally seen.

Leg A. Menez, 27–5–1989, 14 specimens (5 Leeds City Museum, Leeds, 7 Mus. Nat. Hist., Wrocław, 2 in private collection A. Menez, Gibraltar); Gibraltar, leg. A. Norris, 18–11–1990, 4 specimens (A. Norris private collection).

Diagnostic Features: Body length of mature slugs preserved in alcohol from 20 to 80 mm. Body dorso-ventrally flattened; elongate. Skin sculpture delicate. Colour beige-greenish, as if discoloured, in life also yellowish-orange at times. On the sides, blackish almost parallel lateral bands with clearly marked upper edges, fading at the lower edges. Vas deferens thin, visibly separated from the big, thick, spadiceous epiphallus. Spermatheca oval, on a short spermatheca duct. Both the epiphallus and the spermatheca duct open into a short, common duct – the atriopenis. Oviduct shorter than epiphallus, thin, pipelike, opening into the atrium. Atrium very long, tubular or in the shape of a flattened tube.

Description: Body size of specimens at the same phase of ontogenic development varies. The largest live specimen we found was 80 mm long, 10·5 mm wide, with a mantle 27 mm long, while crawling. After preservation in alcohol, the dimensions reduced: body length – 58 mm, width – 11 mm, mantle length – 20 mm. The genitalia indicated that the specimen was not fully mature. The largest preserved specimen we have recorded is 66 mm long, while the smallest mature ones, having a well-formed glandula albuminalis, are only 20 to 24 mm long. It should be noted that most of the specimens, including all the largest ones, were infected with larvae of parasitic nematodes. Although there is no indication that they had been castrated by the parasites, it is possible that the parasites had retarded their sexual maturation process and had thus prolonged their growth.

Body strongly elongate (Figs. 1–2), sides nearly parallel, dorso-ventrally flattened (Fig. 3), as in other species of *Geomalacus*. The whole body is extremely flexible, to such an extent that it can laterally make the letter U so tightly that both sides adhere to each other (Fig. 5). Similar bending capacity in the dorso-ventral plane was not observed, though *Geomalacus maculosus* Allman, 1843 is capable of it. Head is very short, and even when crawling hardly protrudes from under the mantle (2–3 mm). Tentacles relatively long. Posterior body end gently rounded. Caudal gland small, sole edge at the back also rounded on the underside. Between medial line of dorsum and pneumostome 26 grooves, usually. Sole wide, nearly body width. In live specimens it is so transparent in the centre that the viscera are visible. After preservation, the sole is clearly divided into 3 zones, the middle one being at least half the width of the lateral ones. The centre part of the sole is also concave, in the shape of a groove (Fig. 4).

Colouration varies and specimens of the same population differ markedly in both shade and colour intensity, while pattern markings remain more or less the same. Colour uniformly beige-greenish to beige-grey, of a faded tone. In some specimens the anterior parts have an additional yellowish or orange colouration, which disappears in alcohol. Viewed from above, two blackish lateral bands run along the sides of the body. They are nearly parallel and straight, an uninterrupted straight line from the front of the mantle to the posterior part of the body (Figs. 1, 2, 6). In one specimen, however, the lateral bands are interrupted in several places. The upper edges of the lateral line are very distinct. Below that the dark pigment gradually fades away and can be almost absent close to the sole. The middle of the dorsum and mantle is darker, but never as dark as the lateral bands, tentacles brown, sole a dirty cream colour.

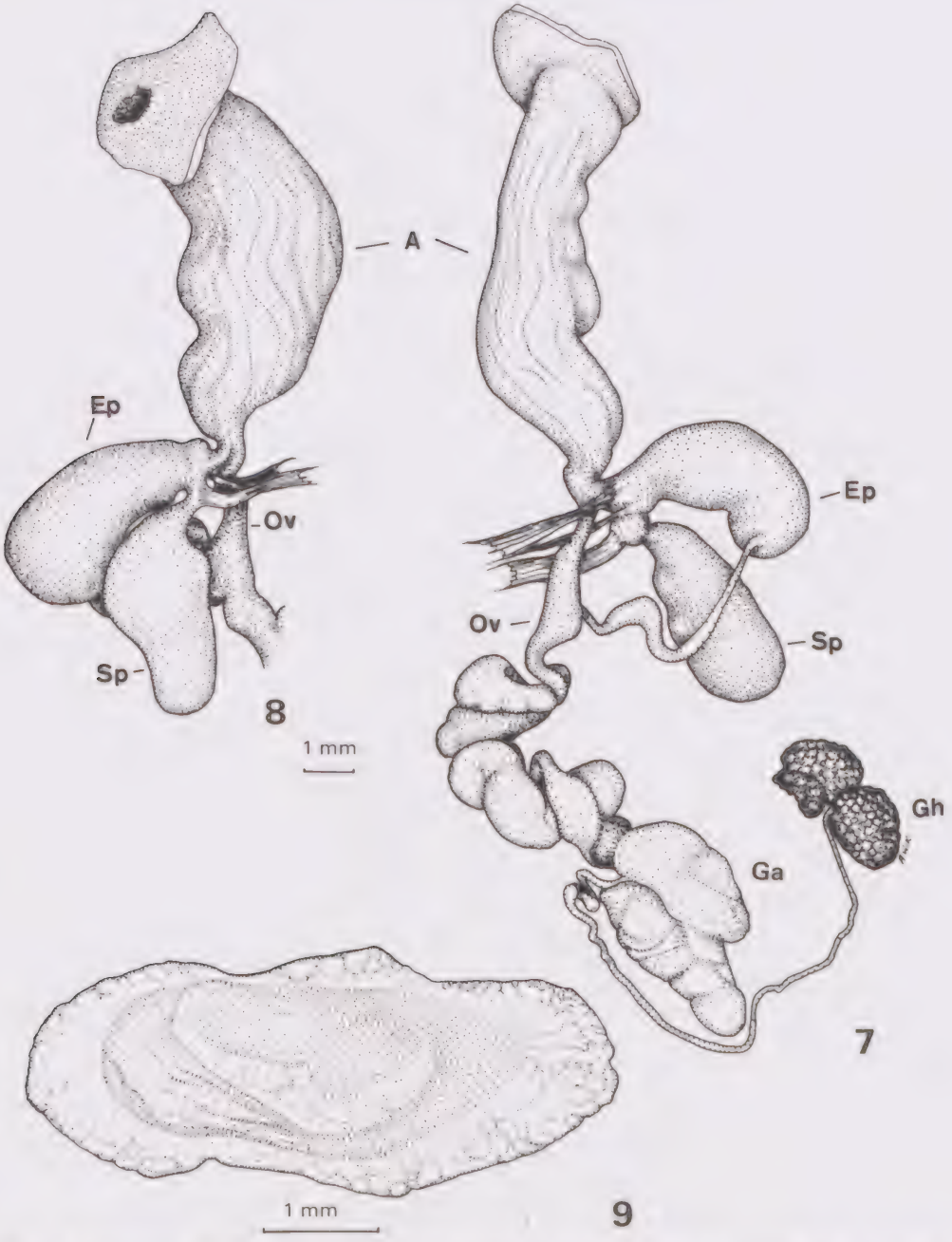
Mucus colourless, transparent and not very thick. Irritated slugs secrete more watery mucus from the head and mantle areas; in some specimens it is orange, but still transparent. The mucus secreted onto the ground while crawling coagulates into a net of lines resembling a spider's web. The tracks look different from those left by other slugs in the genus *Arion* which do not break up into thin threads.

Fig. 6. *Geomalacus malagensis* sp. n. paratype from Colmenar, specimen preserved in alcohol.

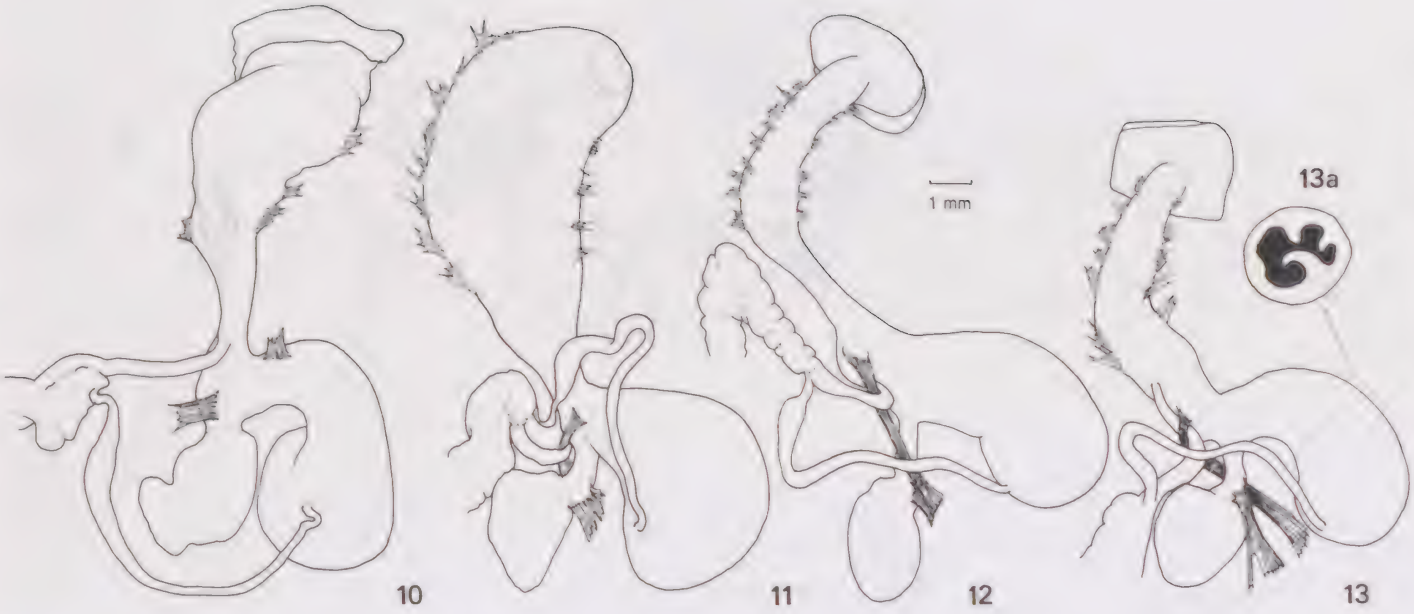
Shell (Figs. 9, 16), asymmetrical, nearly oval, strongly flattened. In lateral view it is also asymmetrical, with a distinct swelling in the posterior part, as if convolute. Growth lines slightly visible on upper surface of shell.

Digestive system (Fig. 14) devoid of any distinctive features.

Genitalia (Figs. 7, 8, 10–13, 15), glandula hermaphroditica smallish, dark-coloured at times. Ductus hermaphroditicus long and thin. Glandula albuminalis not very large, develops very late, i.e. when all other sexual organs are already fully developed. Spermoviductus short, situated in anterior part of the body. Vas deferens long, thin at rear end, then unexpectedly thicker and finally tapering again. Vas deferens opens into the epiphallus



Figs. 7–9. *Geomalacus malagensis* sp. n. 7–8 genitalia of holotype, both side view. A – atrium, Ao – aorta, Ap – atripenis, D – ductus hermaphroditicus, Ep – epiphallus, Ga – glandula albuminalis, Gh – glandula hermaphroditica, Ov – oviductus, R – retractor genitalis, Sp – spermatheca, Spo – spermathecaduct, Vd – vas deferens. 9 – shell of holotype.



Figs. 10–13. *Geomalacus malagensis* sp. n. – copulatory organs of paratypes, 10 – from Benacaz, 11 – from Vejar, 12 – from Gibraltar, 13 – from Gibraltar, 13a cross-section through epiphallus.

slightly to one side, in the posterior part of the organ. Epiphallus large, pear-shaped, slightly bent and somewhat swollen at the back. Inside epiphallus, variable long extended folds, depending on the side through which the organs are cut (Figs. 13a, 15).

Spermatheca oval, large, set on a much shorter spermatheca duct. Both spermatheca duct and epiphallus open into a common organ which Simroth (1894) calls the atriopenis. Thus only the atriopenis is connected to the atrium. Oviductus tubular, short, much shorter than the epiphallus, crossing one of the retractor muscles in parallel with the atriopenis for some distance, and opening beside it into the atrium. Atrium very long in relation to remaining copulatory organs. In young specimens it is tubular (Figs. 10–13); in mature ones it resembles a wide flattened tube (Figs. 7, 11). Atrium adjoins the body walls for about two-thirds of its length. In some specimens the interior walls of the atrium are smooth, whilst in others they are covered with oblong folds, sometimes even visible through the walls of the organ (Fig. 7). Retractor system usually consists of two muscles. The larger one attaches to the spermatheca duct on one side, near to its connection with the spermatheca, while on the other, posterior side, it is attached to the membrane under the pallial complex. The other retractor, which is longer and narrower, is attached to the anterior part of the epiphallus or atriopenis. Oviduct most usually curves over, crossing the retractor. Sometimes, however, the muscle divides and the oviduct is situated between its two branches (Fig. 7). Posteriorly, the retractor is attached next to the retractor of the spermatheca duct, as discussed above. In some specimens both of the retractors meet before their common posterior attachment. Numerous thin fibres hold the atrium close to the body wall, forming a system of retentors. Gonoporus lies anteriorly, next to the head (Fig. 6).

Pallial complex (Fig. 17) closely resembles that of *Geomalacus anguiformis* (Morelet, 1845), described by Wiktor & Parejo (1989).

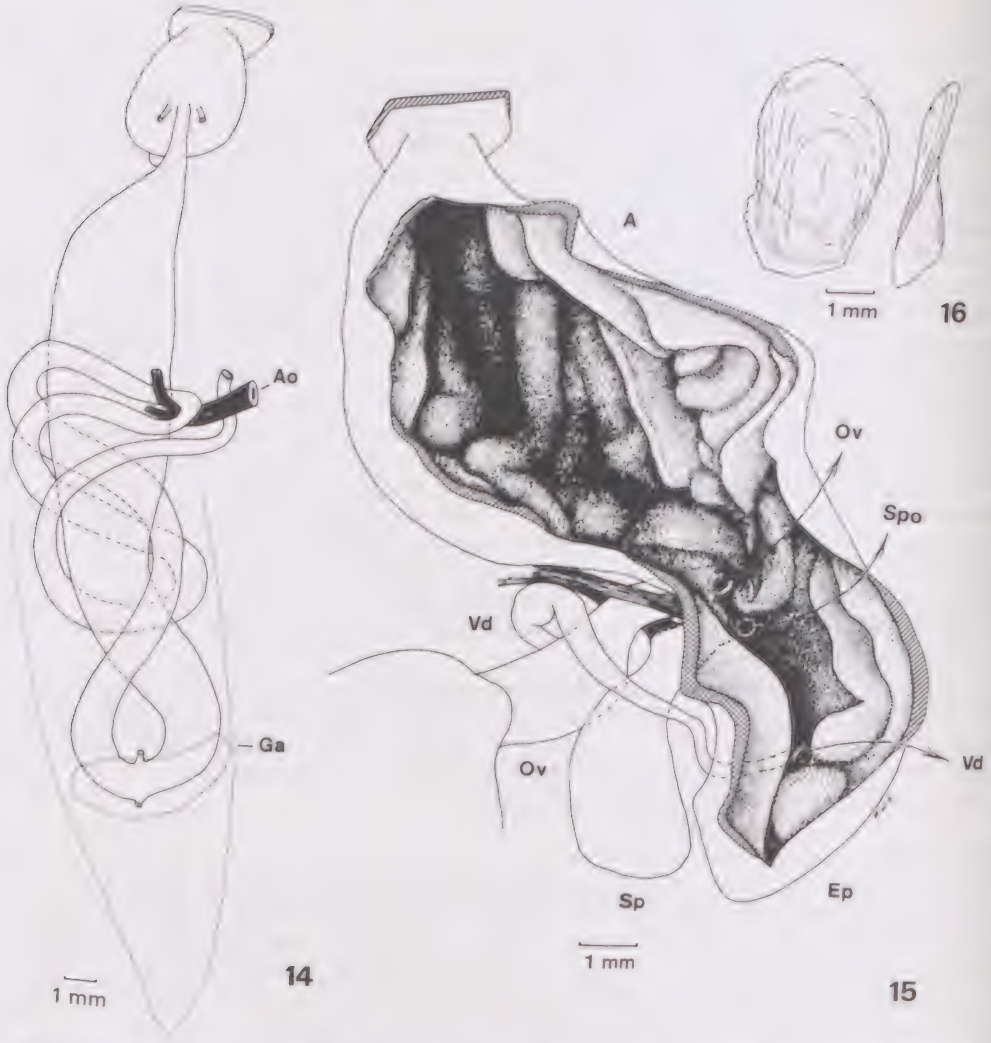
System of head retractors (Fig. 19) is also similar to that of *Geomalacus anguiformis* (Wiktor & Parejo 1989, Fig. 10). The significance of this feature has not been thoroughly studied in taxonomic terms. However, the fact that in all species of *Geomalacus* the retractor pharyngealis is attached towards the back, behind the mantle and somewhat asymmetrically on the right side (Fig. 18), is well known.

Some remarks on ecology and bionomics

Sexually mature specimens are found both in spring (March) and in autumn (October). According to information received from Mr. A. Menez, *Geomalacus malagensis* sp.n. is a common species in Gibraltar, living in masses on calcareous soil, the environment of which is strongly synanthropic, e.g., gardens. It occurs in scrub, *Hibiscus rosasinensis* L., *Dracaena draco* L., *Pinus halepensis* Miller, *Olea europaea* L., *Opuntia ficusindica* (L.), *Acanthus mollis* L., *Chrysanthemum coronarium* L., *Oxalis pescaprae* L. Live specimens sent to Wrocław were reared for 3 months; they fed and grew, but laid no eggs. When killed, all specimens turned out to be infected with nematodes. In captivity, the slugs were mainly active at night. They fed on fruit – tomatoes and cucumber, boiled carrot, and small amounts of cottage cheese.

DISCUSSION

Externally, *Geomalacus malagensis* sp.n. closely resembles *Letourneuxia numidica* Bourguignat, 1866, though it does not seem to grow as large. Colouration and body patterning in both species is so similar that it is very difficult to distinguish between them, especially when preserved. To our knowledge, two or more species of the genus *Arion* existing in Spain can easily be mistaken for this newly-described species. Descriptions of the other species are being prepared by Spanish malacologists. Anatomically, *Geomalacus* differs in having a big,



Figs. 14–16. *Geomalacus malagensis* sp. n. 14 – digestive system of Colmenar paratype, 15 – internal structure of epiphallus and atrium – paratype from Gibraltar (for legend see Fig. 7), 16 – shell of Gibraltar paratype – side and bottom view.

spadiceous epiphallus which *Letourneuxia* lacks. The shape of the atrium is also different, as it does not have the characteristic ligula type organ which fills the pear-shaped atrium of *Letourneuxia* (Wiktor 1983, Figs. 7–9). The basic difficulty in describing a new species from the Iberian Peninsula and northern Africa is to firmly establish the relationship between the names used in old descriptions and currently identified taxa. We have to consider the possibility that this species may have been previously described. *Arion (Ariunculus) moreleti* Hesse, 1884 was first suggested by Norris (1977), but Wiktor (1983) synonymized *A. (A.) moreleti* with *Letourneuxia numidica*. A figure, (Hesse 1884, Fig. 3), shows genitalia strongly distorted by preservation. Hesse also gives a very detailed description on page 16 (Hesse

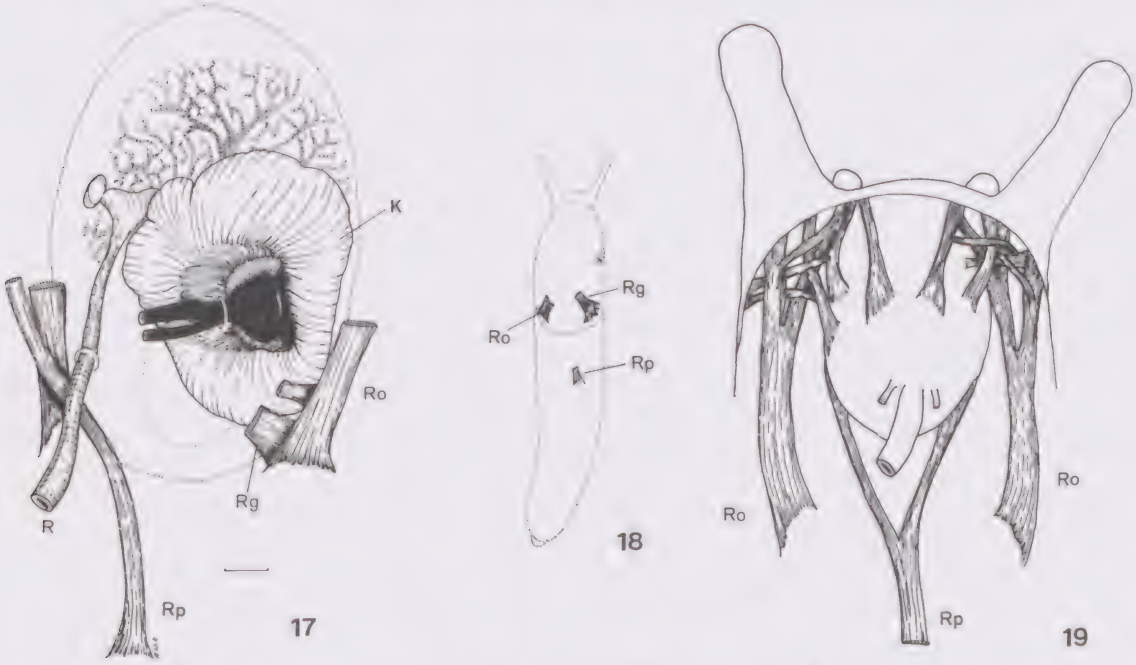
1884): 'ist der sehr kurze and wenig entwickelte Penis . . . der fast unmerklich in das vas deferens übergeht . . .'. This is a feature which rules out our newly-described species. By 'Penis' Hesse means epiphallus or vas deferens. Therefore, it is debatable as to how this species should be classified, and whether it belongs to *Geomalacus* or *Arion*. We discuss this problem below.

Remarks concerning the systematics of arionids at generic level

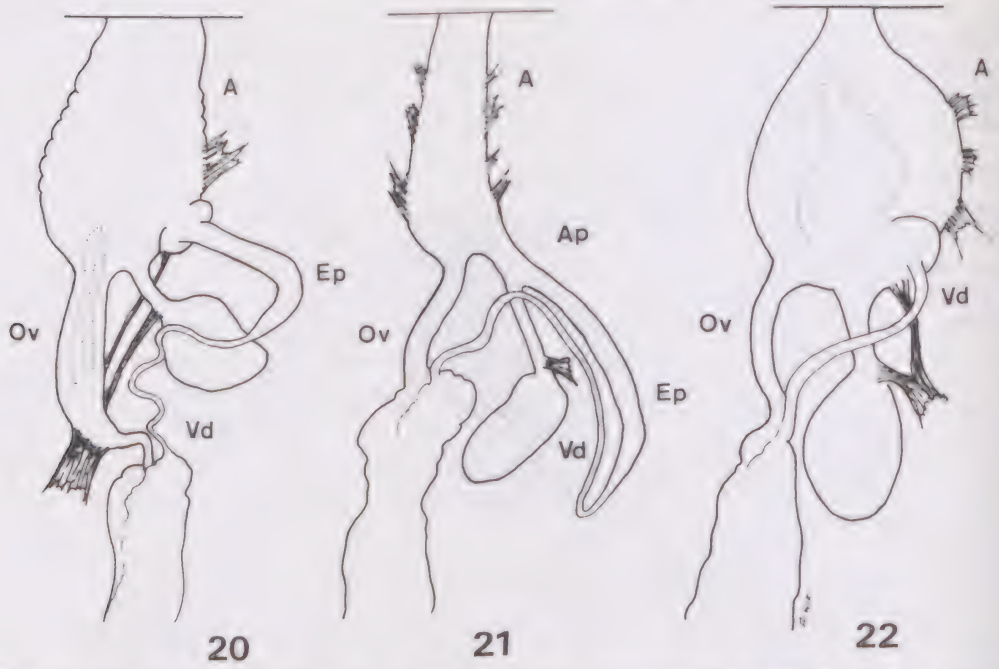
The intra-family systematics of Arionidae used to date was first introduced by Hesse (1926), but is now considered unsatisfactory. Wiktor (1983), raised the old subgenus *Letourneuxia* Bourguignat, 1866, to generic status, the other genera being *Arion* Férussac, 1819 and *Geomalacus* Allman, 1842. The differences between the three groups are undoubted, but the distinctions given by Hesse (1926) are insufficient. The new species *Geomalacus malagensis* proves that Hesse's diagnostic characters are inadequate, as it could be classified within any of the genera if his criteria were used. Hence, we suggest below additional diagnostic characters, while retaining for now at least, the division of the Arionidae into three genera. The diagnoses are as follows:

a). *Arion* Férussac, 1819 – shell made of loose or irregular lumps of crystal. Dorsum usually visibly convex, making it hemispherical in cross-section. Posterior insertion of musculus retractor pharyngealis lies in the mantle area. Oviductus, spermatheca duct and epiphallus each open separately into the atrium (Fig. 20).

b). *Geomalacus* Allman, 1842 – shell oval, asymmetrical, uniform with slightly marked but visible concentric growth lines. Body dorso-ventrally flattened, (best observed in live slugs). Posterior pharyngeal retractor insertion lies relatively distant from the posterior edge of the mantle, somewhat asymmetrically on the right side. Spermatheca duct and epiphallus open



Figs. 17–19. *Geomalacus malagensis* sp. n. 17 – bottom view of pallial complex – key, K – kidney, R – rectum, Rg – retractor genitalis, Ro – ommatophore retractor, Rp – retractor pharyngealis, 18 – topography of posterior retractor attachments, 19 – head musculature of a specimen from Gibraltar.



Figs 20–22. Copulatory organs. 20 – *Arion*, 21 – *Geomalacus*, 22 – *Letourneuxia* (for key see Fig. 7). Diagrammatic.

into one common duct situated on the extension of the atrium which Simroth called the atriopenis. The localization of the insertions of the branched genital retractor indicates that the organ may be everted. Oviductus opens into atrium independently (anteriorly relative to atriopenis) (Fig. 21).

c). *Letourneuxia* Bourguignat, 1866 – shell oval, asymmetrical, uniform, with weakly marked concentric growth lines. Body dorso-ventrally flattened. Posterior musculus retractor pharyngealis insertion lies beyond the mantle area, but very close to it. No epiphallus. Thin vas deferens, spermatheca duct and oviductus open each into the atrium separately. Inside the pear-shaped atrium nearly all the space is filled by a large tongue-shaped organ. The localization of this organ, its origin, and function, suggests that it is not homologous with the organ called the ligula in *Arion* (Fig. 22).

With its numerous species, the subgeneric classification of the genus *Arion* requires revision. The genus occurs from northern Africa to the Caucasus and the Far East (Likharev & Wiktor 1980). *Geomalacus*, with its three species, including the one described above, is only known from the Iberian Peninsula and south-west Ireland (Platts & Speight 1988, Wiktor & Parejo 1989). *Letourneuxia*, with its one recorded species (Wiktor 1983), is only known from north-west Africa, but will presumably be recorded eventually from the Iberian Peninsula.

Geomalacus malagensis sp.n. belongs to *Geomalacus* because it has an epiphallus which is connected to the spermatheca duct, (although the atriopenis is very short), and a retractor pharyngealis insertion which is situated in a similar place to other species of *Geomalacus*. The similarity is also evident in the flattening of body, location of the gonoporus, sole structure and head musculature.

ACKNOWLEDGEMENTS

Many of our friends have contributed the material essential to the preparation of this paper. We would especially like to thank Mr Alexander Menez A.I.M.L.S. from Gibraltar who provided us with a large series of live specimens, and his own observations, Dr Ewa Bylińska (Wrocław), who, at our request collected the initial material, and other collectors whose names are mentioned in this paper. We also appreciate the help of Ramón Martín (Bilbao) and Dr Wolfgang Rähle (Tübingen) who gave us access to their collections.

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ON SOME FRESHWATER MOLLUSCS (GASTROPODA AND BIVALVIA) FROM SIERRA LEONE

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(*Accepted for publication, 20th October, 1990*)

Abstract: Freshwater molluscs (Gastropoda and Bivalvia) were sampled in the Moyamba and Bo districts of Sierra Leone in 1986. *Bulinus senegalensis*, *Caelatura aegyptiaca* ssp., and *Mutela ovata* are recorded for the first time from Sierra Leone. *Sierraia whitei* is confirmed to occur in the Sewa river drainage. The other species collected are *Saulea vitrea*, *Sierraia leonensis*, and *Etheria elliptica*.

INTRODUCTION

The knowledge of the composition of the African freshwater malacofauna and the distribution of species has recently increased but is far from being complete. Brown (1980), Mandahl-Barth (1988) and Van Damme (1984) have published extensive surveys of what is known on these subjects. The occurrence and epidemiology of schistosomiasis has been a great impulse to study freshwater gastropods with emphasis on the genera *Bulinus* and *Biomphalaria*. Geographical and ecological data are scarcer for other taxa and they are most often incomplete. Furthermore most groups need a thorough revision of their respective taxonomy and systematics. This is true especially for the bivalves where most of the data were gathered in the first half of this century and have been ordered almost exclusively from a conchological viewpoint.

Hubendick (1977) is the only author to deal with freshwater gastropods of Sierra Leone in detail. The material for his survey dates back to the year 1959. Recently Brown (1988) revised the bithyniid genus *Sierraia* adding three new species to this formerly monotypic genus. In 1986 freshwater molluscs were collected in the districts of Moyamba and Bo (West) of Sierra Leone. These collections yielded some remarkable species which will be presented in systematic order.

SAMPLING LOCALITIES AND TAXONOMY

Freshwater molluscs were collected at five different localities (see Fig. 1):
1) Moyamba, River Gbangbar (or: Gbangbai) within the city,
2) Moyamba, swamp (FAO demonstration site) within the city, drained by a small tributary of the Gbangbar,
3) Kwelu, a village about 12 km north of Moyamba, River Gbangbar, immediately near the village,
4) Bundubu, a village about 10 km south of Moyamba, direction to Shenge, River Gbangbar immediately near the village,
5) near the village of Mokpendeh, River Tabe, about 1 km before flowing into River Sewa.

Localities 1) to 4) are situated in the Moyamba district, locality 5) is situated in district Bo-West. All localities are within the interior plain, not exceeding 150 m above NN in

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Fig. 1. Map of Sierra Leone with sampling sites (numbers referring to the localities described in text.)

altitude. For further information on physiography, hydrology, and climate, reference should be made to Clarke (1976). The taxonomy of the gastropods follows Brown (1980, 1988) while that of the bivalves follows Mandahl-Barth (1988). For the bivalves reference is made to the previous classifications of Haas (1936, 1969). If not otherwise stated the voucher specimens are kept in the collection of the author.

PLATE 3 (Opposite)

Fig. 1. *Mutela ovata*, outer shell surface, locality 3, length 115 mm. (× 0.75)
Fig. 2. *Mutela ovata*, inner surface of the same shell with pseudotaxodont hinge. (× 0.75)
Fig. 3. *Caelatura aegyptiaca*, locality 5, length 35 mm. (× 1)
Fig. 4. *Etheria elliptica*, locality 5, longest diameter 73 mm. (× 0.75)

PLATE 3

RESULTS

Gastropoda, Prosobranchia, Ampullariidae:
Saulea vitrea (Born, 1780)
4 specimens, coll. 26.4.86, locality 1)

Prosobranchia, Bithyniidae:
Sierraia whitei Brown, 1988
19 specimens, coll. 13.5.86, locality 5), 3 specimens of which are in the collection of the British Museum (Natural History), Department of Zoology, Experimental Taxonomic Unit, accession number ETU 4176.

Sierraia leonensis Connolly, 1929
1 specimen, coll. 13.5.86, locality 5), in the collection of the Danish Bilharziasis Laboratory (catalogue number DBL 861216F–02)

Pulmonata, Planorbidae:
Bulinus senegalensis Müller, 1781
3 specimens, coll. 12.5.86, locality 2), in the collection of the Danish Bilharziasis Laboratory (catalogue number DBL 861216F–01)

Bivalvia, Unionidae:
Caelatura aegyptiaca (Cailliaud, 1827) ssp.
19 1/2 specimens, coll. 13.5.86, locality 5)

Mutelidae:
Mutela ovata (Swainson, 1823)
2 11/2 specimens, coll. 29.4.86, locality 3), 5 specimens, coll. 1.5.86, locality 3), 1 4/2 specimens, coll. 15.5.86, locality 4)

Etheriidae:
Etheria elliptica Lamarck, 1807
9 1/2 specimens, coll. 13.5.86, locality 5)

COMMENTS

Saulea vitrea
This species only occurs in Liberia and Sierra Leone with doubtful fossil records from East Africa. The present finding is well within the range reported by Hubendick (1977), the lowland area of the country. All animals were picked from stones which were fully exposed to the sun. These stones lay in the middle of a weak current in the River Gbangbar. The water was moderately turbid from organic matter.

Sierraia whitei
This genus is endemic to Sierra Leone. Brown (1988) added 3 new species to this formerly monotypic genus. One of these new species is *S. whitei*. The sampling locality of *S. whitei* reported here is of special interest as it confirms the suspicion of Brown (1988) that more than one species of *Sierraia* is living in the River Sewa drainage. The shells had been washed to the banks of the river and only one had the operculum still present. All of the shells are decollate to various degrees.

Bulinus senegalensis

This species is reported here for the first time from Sierra Leone. It was previously known from Gambia, Senegal, Mauritania, and northern Nigeria (Brown 1980, Betterton 1984). The present finding indicates a more southern distribution in West Africa. In Gambia it was found abundantly in seasonally filled rain-pools on the laterite plateau. The locality reported here differs from this type of habitat primarily in the fact that the brook which drains the swamp normally does not dry out. In the dry season it has a weak flow of moderately turbid water. The bottom of the brook is rich in organic debris. The snails were collected by sieving the bottom. *B. senegalensis* is an intermediate host for *Schistosoma haematobium*, *S. bovis*, and *S. intercalatum* (Brown 1980).

Caelatura aegyptiaca ssp.

The shells belong to the West African subspecies of *Caelatura aegyptiaca*. The oldest form from this part of Africa was reported under the name *Unio juliani* Rang, 1835. This subspecies is known from a number of localities in Senegal, Guinea, Ivory Coast, Ghana, Nigeria, and Chad (Mandahl-Barth 1988 and pers. comm.). The shell form of the specimens is well within the range given by Mandahl-Barth. It is reported here for the first time from Sierra Leone.

Mutela ovata

There has been only one exact locality record for this species to date (Mandahl-Barth 1988). It has been reported from Liberia (*fide* Haas 1969) and Senegal (SMF 12668). Other series in the Senckenberg Museum (Frankfurt/M., West Germany) refer to 'Africa' or 'South Africa' (SMF 12265, 12266, 12267, 168346). There are slight differences between the shells of the Senckenberg collection and the shells from Sierra Leone. First of all the colour of the periostracum is of dark olive to dark brown in the latter ones. They only sometimes show zones of a clear green colouration. On the other hand the periostracum is of a bright yellowish green in all museum specimens with the colour becoming light to dark brown towards the margin of the shell. Radial bands are prominent on the lightly coloured shells from the museum while they are hardly visible on that dark coloured shells from Sierra Leone. The umbo of all museum specimens is fairly tumid, being well visible above the hinge line when viewed from the inside. In contrast to this the umbo of the Sierra Leone specimen is hardly tumid and only insignificantly raised above the hinge line. In both cases (museum specimens and shells from Sierra Leone) there is no umbonal sculpture visible. The nacre is of a faintly pink to violet colour in all shells.

The mussel is a common food to the people of Kwelu and perhaps many other villages. It is searched for by hand in sandy parts of the river.

Etheria elliptica

This 'river oyster' inhabits tropical Africa and Madagascar. In the Tabe river the animals were found attached to large blocks of stones both near the banks and in the middle of the river. River oysters are collected by the people of adjacent villages as food. For this purpose the complete animal including the attached shell valve is broken off from the rock with a knife.

DISCUSSION

Although very limited in range the sampling of freshwater molluscs reported here produced some remarkable results. Among them is the second exact locality ever reported for *Mutela ovata*, first records of *Caelatura aegyptiaca* ssp. and *Bulinus senegalensis* for Sierra Leone.

Furthermore, the presence of *Sierraia whitei* in the Sewa drainage could be confirmed. These results show that our knowledge on the distribution of freshwater molluscs of West Africa is far from being complete.

The same is true for the taxonomy of certain groups, too. While intensive sampling and a closer look at differentiating characters led to the discovery of three new species within the genus *Sierraia* (Brown 1988) the opposite result was reached with the Unionidae (Mandahl-Barth 1988). The latter author for instance estimates that many of Haas' (1936, 1969) genera and subgenera of *Caelatura* and related forms are superfluous. Indeed the material collected in Sierra Leone exhibits similarities with several of the nominate species in the sense of Haas (1969). The overall shape is close to his *Caelatura* (*C.*) *juliani* (Rang, 1835) (referred to *C. aegyptiaca* by Mandahl-Barth) and *Mesafra mesafricana* (Pilsbry & Bequaert, 1927) ssp. *stappersi* (referred to *Caelatura mweruensis* (Smith, 1908 SMF 10092). The Sierra Leone shells, too, strongly resemble specimens of *Caelatura* (*Kistinaia*) *schoutedeni* Haas, 1936 present in the Senckenberg Museum (SMF 10088–90). This 'species' is referred to *Caelatura mweruensis* (Smith, 1908) by Mandahl-Barth. In this case as in many others the overall shape does not seem to be of great value in disclosing genetic relationships among the Unionidae. The hinge is almost of the *aegyptiaca*-type in the sense of Mandahl-Barth. The hinge teeth are very smooth and not very prominent in the shells from Sierra Leone. In some cases this may be an effect of erosion. Incidentally, the auxilliary tooth in the right valve is missing or hardly visible. The umbonal sculpture is essentially the same as in *Caelatura* (*C.*) *juliani* according to the description of Haas (1969). In most specimens it has been eroded. The shell characters used to define species (umbonal sculpture, overall shape, shape of hinge teeth) are known to be influenced by environmental factors to various degrees. This fact underlines the need for a thorough revision of the systematics of African Unionidae.

The discovery of *Bulinus senegalensis* in Sierra Leone is of medical importance as this species is an intermediate host for *Schistosoma haematobium*. Other possible hosts have already been reported by Hubendick (1977): *Bulinus globosus* (Morelet, 1866) and *B. jousseaumei* (Dautzenberg, 1890). The occurrence of *Schistosoma haematobium* and bilharziasis in the district of Moyamba has still to be checked but the present finding demonstrates a possible threat for human health.

ACKNOWLEDGEMENTS

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J. Conch. **34:** 37–38 (1991)

OBITUARY

LOTHAR FORCART 1902–1990

Although doubtless several complete obituaries with bibliographies will be published on the Continent, it would be remiss not to notice the death of Lothar Hendrich Emil Wilhelm Forcart-Müller in our pages since he joined our Society as long ago as 1930. We have lost one of our oldest members who published a very large number of papers on land molluscs, many of which are destined to become standard reference works for a very long time. I have nearly 60 of his titles in my own library and the total must be several times that figure. I had been in contact with him for about 40 years and always found him invariably helpful.

Forcart was born in Basel on 10 December 1902, the fourth child of Rudolf and Anita Forcart-Bachofen and had a happy childhood in ideal surroundings marred, however, by the premature death of his father. His mother tried very hard to make good this loss with ever ready advice and help. Since his early youth he had a great interest in nature and after his schooling studied science with zoology as his main subject. At the instigation of Prof. Friedrich Zschokke he worked up the molluscs of the Graubünden Canton and bordering Italian alpine valleys and studied their recolonisation since the end of the Glacial Period. After studies in Basel, Berlin and Cambridge culminating in his doctorate (the last supervised by Prof. Zschokke) he worked for seven years as a voluntary collaborator at the Basel Natural History Museum, at that time under the direction of Dr. George Stehlin and Dr. Fritz Sarasin, both of whom became Lothar's models for his long years of museum activity.

In 1936 he made a scientific journey to Asiatic Turkey where he collected on the then poorly known Black Sea coast and interior areas. The ensuing publications resulted in much additional material from other people sent to him for determination. A monograph of the Turkish Enidae was one notable result of this undertaking.

On 8 December 1937 he married Ann Müller and they enjoyed an exceedingly happy marriage until her death in October 1986. She had great understanding for, as he put it 'my somewhat eccentric interests'. They made numerous collecting trips in the Alps and Italy including the far south, at that time scarcely touched by tourists. In later life these enjoyable expeditions were amongst their happiest memories.

In 1938 he became curator of the Zoology Department at Basel and later Director. It was his main intention to rearrange the zoological collections according to modern standards and catalogue and work on them scientifically. Unfortunately all his plans were not realised and it was only long after his retirement that the public galleries were modernised and the old-fashioned building renovated. As is usual his scientific work resulted in numerous worldwide friendships and he and his wife often offered hospitality to visiting colleagues. He was one of those instrumental in setting up *Unitas Malacologica* in London in 1962.

He worked on many groups but of particular note are his studies on African Veronicellidae (a complete monograph), Vitrinidae (particularly of the Alps), *Perforatella*, *Trichia*, *Lehmannia*, *Columella*, Zonitinae and Middle Eastern molluscs. Not all his conclusions have been accepted, particularly his work on *Trichia* in so far as it affects our British species. I hold in particular regard his little book *Schnecken und Muscheln* in the series Die Hallwag – Taschenbücherei, almost a miniature book at 6 × 4¼ inches with delightful coloured plates. My copy was given to me by a colleague in Nairobi, Peter Bally whose name was sometimes written Bally-Forcart, a collateral relation of the family.

Forcart was a kind and helpful man and meticulous correspondent. I frequently turned to him with problems of palaearctic molluscs which he answered with unfailing courtesy.

Workers with such far ranging expertise are now virtually non-existent and their published work merely a tithe of their knowledge.

At the end of 1967 he retired from the museum and worked at home. In 1968 the Israel Academy of Sciences and Humanities invited him to work on terrestrial molluscs for '*Flora Palaestina*' and in 1969 he travelled in Israel in order to get to know the country and also examine the existing collections in various institutions. This work and its interesting problems kept him busy for most of the rest of his life and brought him into contact with a younger generation of research workers.

The death of his wife grieved him deeply, also the thinning out of his worldwide contacts. He stopped work and spent his last years reading abut the history of science. He was a fortunate man with a happy life, and harmonious marriage who worked at what interested him most.

This is mostly based on personal details recorded by himself in 1977 and 1989 and my own personal knowledge.

BERNARD VERDCOURT

J. Conch. **34:** 39 (1991)

COMMUNICATIONS

TWO NEW BRITISH RECORDS FOR *MYXAS GLUTINOSA* (MÜLLER)

The lymnaeid *Myxas glutinosa* (the glutinous snail) is one of only two species of snail (and 20 species of invertebrate) which is protected in Britain under Schedule 5 of the Wildlife and Countryside Act. The last record for *M. glutinosa* in Britain is from Lake Windermere in 1957 and the last record for lowland Britain from around Norwich in 1940 (M. P. Kerney pers. comm.). In contrast to its present rarity, the species used to be relatively widespread in England and Wales. The decline of the species is thought to be associated with the general decrease in the quality of surface water in Britain over the past century.

M. glutinosa has now been rediscovered during the course of the National Pond Survey, co-ordinated by Pond Action from Oxford Polytechnic, at a site in the Oxford area (SP50). Two living specimens, one mature and one juvenile, were recorded in November 1988, and several living juveniles recorded in July 1990. The new site is quite close to the sites of some old records for the species, the most recent of which is from 1916.

The site at which the species has been found is an old, flooded, gravel pit which has a seasonal connection to a network of surrounding watercourses. The site has a rich snail fauna, 19 aquatic species being recorded from two visits. The site also has an excellent flora including the local species *Potamogeton praelongus* (long-stalked pondweed), also thought to be declining rapidly due to a decrease in surface water quality (T. G. C. Rich pers. comm.).

The known habitat preference for *M. glutinosa* is for firm surfaces and crystal clear water (M. P. Kerney pers. comm.). Unfortunately, the present condition of the site, with a silted base and much green algae, appears to be far from ideal for this species. In addition, it appears that the condition of the site has been deteriorating over the past few years. It is evident that very careful management will be needed in order to ensure the continued survival of *M. glutinosa* at this site.

This record stimulated Mr. D. Whitely, to extract from his collection a specimen of *M. glutinosa* collected from the Basingstoke canal (SU85) in 1969. This specimen was taken from the bed of the canal when a section had been drained down. The shell was adult and appeared to be fairly fresh.

The canal, which is the richest site for aquatic plants in the U.K., has been undergoing a continuous restoration programme since the early 1970s, and will be fully opened to navigation in 1991. English Nature is concerned about the pressures that the opening will have on the flora and fauna of the canal (P. Tinning pers. comm.). If *M. glutinosa* is still present in the canal, it may well be one of the first species to suffer.

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MAIZANIA MARSABITENSIS VERDC. (MAIZANIIDAE) IN TANZANIA

A single specimen of *Maizania marsabitensis* Verdc. (*Arch. Molluskenk.*, **92** (1963) pp. 15–17) was found in the East African collection made by Å. Holm loaned to me by the Natural History Museum in Stockholm. This had been collected in Tanzania on the rim of Ngorongoro Crater at 2250 m on 19th March 1969, *Holm* 223/224; it occurred with *Afroconulus iredalei* (Prest.), *Guppya rumrutiensis* (Prest.), two indeterminate Helicidae and a juvenile *Gulella*. This represents a considerable extension of range of about 500 km, apart from a new territorial record.

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INSTRUCTIONS TO AUTHORS

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